KOREA –
A New Threat

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AIR FORCE JOURNAL of LOGISTICS

ENVIRONMENTAL CHALLENGES –
Base Conversions –
New Technology and Concepts –
Prevention Programs –
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FRONT COVER: (Foreground) An inoperable B-52D Stratofortress aircraft is demolished so that the metal can be recycled. (USAF Photo)

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CONTENTS

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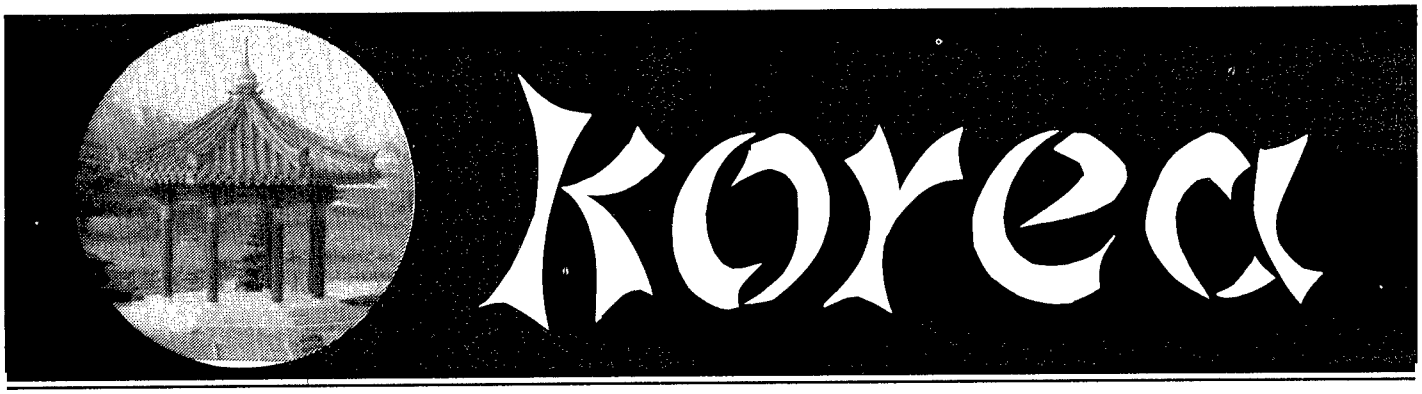

The Korean Peninsula: A Hotspot Once Again

Lieutenant Colonel Andrew J. Ogan, USAF

Introduction

The fall of Communist regimes throughout the world has heralded a new era in world diplomacy. The former Soviet Union, an enemy for so long, is now our friend. The Berlin Wall has fallen, and the two Germanys are now one. Of the Communist nations that once posed a threat, only China, North Korea, and Cuba remain. Out of these three, only the Democratic People's Republic of Korea (DPRK) is considered a real challenge to peaceful progression.

In recent times, Korea has been a continual source of interest to the United States. US involvement on the peninsula dates back over 40 years. Indeed, the US commitment to the Korean peninsula—as well as the maintenance of the Republic of Korea (ROK) as a viable nation—is based on the outcome of the Korean War. Since the Armistice, the US has maintained a visible presence and an integrated US-ROK command structure. With the collapse of communism worldwide, there is some doubt that DPRK still poses a threat; however, with recent activity along the border, and rumors of a buildup of nuclear weapons, we must remain cautious.

Within this article, we will examine the DPRK threat. To do so, we will briefly highlight the current political and economic conditions in both the DPRK and the ROK. With that basis of understanding, we will move to the military conditions in each country. Finally, we will evaluate the likelihood of war and, if war erupts, the probable outcomes.

Political and Economic Conditions

Political and economic conditions can sometimes indicate an inclination toward war. Since the conclusion of the Korean War, both the political and economic paths of the two Koreas have markedly diverged. A brief examination into the conditions within each Korea will provide a good basis for future discussion of military conditions and war predilections.

Democratic People's Republic of Korea

Kim Il Sung has led the DPRK since its creation in 1948. The 82-year-old leader has confirmed his son, Kim Jong Il, as his successor. Together, this father-son team rules through the Korean Worker's Party Politburo. For decades, the DPRK has advocated "juche," or self-reliance, as a means to insulate the nation from outside influences. Lately, that policy has become little more than political rhetoric as the economies of other nations have far surpassed the DPRK. (14:31-33) However, the centralized nature of decision making within the DPRK has not changed. Table 1 lists some key macro-measures for DPRK status and performance.

Population: 21,984,000
Gross Domestic Product (US$): 47.94 Billion
Per Capita Income (US$): 1123
GNP Growth Rate: –3.7

Table 1. Democratic People's Republic of Korea, Macro-Statistics.

The political upheaval within Eastern Europe and the old Soviet Union has had some significant impacts on the DPRK. Crude oil which once flowed from the Soviet Union has been significantly cut—by 25% in 1990 alone. (3:263) The new East European governments, formed since 1990, have been more prone to deal with the ROK rather than with the DPRK. (10:11) Both the old Soviet Union and China, the primary allies of the DPRK, have surprisingly established strong economic ties to the ROK. (3:5-6)

Economically, the DPRK is stagnant. Reports, for instance, on the agriculture sector indicate that production has not increased in over seven years. The end result is that basic foodstuffs are habitually in short supply. Shortages of materials and fuel have caused industrial usage to fall to 50% and below. The cost of the breakup of the Soviet empire is a further drag on DPRK's economy. There has been a real drop in the Gross National Product (GNP)—down 3.7% in 1990. Further drops in the GNP are expected into the future. (12:136-137) Finally, the DPRK has been unable to meet foreign debt payments, leading some nations to close embassies and foreign businesses to avoid commercial activities in the DPRK. (19:209-210)

To counter these political and economic problems, the DPRK has embarked on several diplomatic initiatives. First, the DPRK has more closely aligned itself with China. China was the primary nation involved in assuring that both the DPRK and the ROK were allowed to join the United Nations. (12:141) Second, the DPRK has initiated diplomatic discussions with

Japan. In a joint statement, Japan apologized for World War II occupation and then offered remuneration or damage payments for the period up to 1945. The DPRK, for its part, released captured and detained Japanese fishermen. (14:37-38) Third, the DPRK has attempted to cultivate relationships with the nonaligned community. This initiative has not been particularly successful and has resulted in some criticism of the DPRK for human rights abuse. (14:41-43)

The Republic of Korea

Although a major industrialized nation and the seventh largest trading partner with the US, the ROK has suffered through periodic stages of political unrest. The ruling Democratic Justice Party lost its absolute majority in 1992 and was forced to include two other parties to form a conservative alliance called the Democratic Liberal Party. (6:218) To observers, this represented a significant change in ROK politics toward a more pluralist democracy. (12:134-135) Table 2 provides the pertinent comparative data with the previous DPRK data.

Population: 42,773,000
Gross Domestic Product (US$): 239.77 Billion
Per Capita Income (US$): 2296
GNP Growth Rate: 7

Table 2. Republic of Korea, Macro-Statistics.

Economically, the ROK is second to Japan in GNP in the Asian region. The capital, Seoul, contains 25% of the population and over 50% of the nationwide GNP. This capital city also is 26 miles from the Demilitarized Zone (DMZ). (19:201) The ROK GNP is growing at 7% annually with a 10% inflation rate. However, the GNP growth appears to be slowing, and there is some concern over declining competitiveness. Because the GNP is highly dependent on exports (over two-thirds in 1987), the ROK economy is highly vulnerable to events in foreign markets. (4:121) The per capita income within the ROK is expected to double between 1985 and the year 2000. The ROK is examining ways to increase investments in research and development to maintain its growth and to enhance competitive prospects into the future. (9:19-22)

Diplomatically, the ROK has had a number of successes. Within Eastern Europe, the ROK has successfully opened several promising commercial ties. (18:247) China and the ROK are, similarly, working on commercial arrangements. Trade between these two nations topped $3 billion in 1988; interestingly enough that is six times the amount between China and the DPRK. The ROK has shown interest in reunification, but the uniting of the two Germanys previewed a cost that has given the ROK some pause for thought. At present, the ROK would like to encourage a minimum growth economy in the North until the proper time presents itself for reunification. (12:141)

Military Conditions

Despite the disparate economic and political developments within the two nations, both the DPRK and ROK have built large, relatively modern military forces. In addition, the ROK has the valuable support of the US. In the following paragraphs, the capabilities of the DPRK and the ROK forces will be examined in tandem with the ability of the US to support sustained operations.

DPRK Forces

The DPRK boasts forces totaling over 1.1 million strong. One million are Army resources; another 41 thousand and 70 thousand are in the Navy and Air Force respectively. (11:167-168) To build and maintain such a force, the DPRK has invested almost 20% of its GNP annually. (22:46) Without mobility, however, this force is largely emasculated and the reduction in fuel shipments from the Soviet Union may ultimately affect that mobility. A breakdown of some of the key equipment areas is contained in Table 3.

Main Battle Tanks: 3500
Armored Personnel Carriers: 4000
Towed Artillery: 2500

Table 3. Democratic People's Republic of Korea, Key Force Statistics.

The DPRK has made significant investments in the areas of chemical/biological and nuclear weapons. (5:226) With recent reports that the DPRK is producing nuclear weapons, along with its reluctance to allow inspections of all its nuclear facilities, many countries have become worried and watchful. Since President Eisenhower declared a readiness to use nuclear weapons on the peninsula, the DPRK has aggressively developed both the nuclear and the chemical/biological weapons. There is a deep-seated suspicion that the ROK-US forces would ultimately introduce such weapons into any war. As a result, the DPRK has a stated policy of "first-use." (5:228)

ROK Forces

The ROK maintains a military of over 750 thousand troops. The ROK forces have developed into a high-quality fighting machine. (10:23) The Army numbers 650 thousand with the Navy and Air Force containing 60 thousand and 40 thousand respectively. (11:169-170) The ROK level of investment has recently matched that of the DPRK, but at a lower percentage of GNP. Only 3.5% of the ROK GNP supports its military forces. (22:46) Table 4 provides comparative data on the ROK forces.

Main Battle Tanks: 1550
Armored Personnel Carriers: 1550
Towed Artillery: 4000

Table 4. Republic of Korea, Key Force Statistics.

The ROK does not have nuclear capabilities but relies on US capabilities. While it is US policy not to respond to nuclear weapon inquiries, President Clinton has indicated that, at present, the US would not consider the use of such weapons. (4:118)

US Forces

The US presence is relatively minor—more a visible commitment than an armed deterrence. Only two of the DMZ outposts are now manned by US forces. That minor presence amounts to a force of approximately 37 thousand, made up of over 26 thousand Army and 85 hundred Air Force. More importantly, however, this small physical US presence signals a strong commitment to reinforce positions should a conflict erupt. (11:170)

The US maintains a logistics structure designed to allow for rapid buildup during time of tension or actual combat. And, with the "New World Order," US investment in and dependence on this capability will likely grow. (16:13) An excellent example is the centralized intermediate repair operation. The Air Force has, since 1977, implemented and maintained a centralized intermediate repair facility at Kadena AB, Japan. This facility serves as a key repair operation outside of what would be the combat area. Sophisticated repairs and overhauls can be accomplished. As a result, air units can be flown into and supported within the theater with little organic maintenance. (1,2)

The airlift and sealift capacities of the US assure rapid deployment of augmenting forces and key resources such as munitions and fuels. The Desert Shield/Storm example illustrates the immense airlift capabilities that can move large numbers of people, equipment, and supplies over large distances in relatively short periods of time. That airlift capability made people and munitions combat available within a very few days. (20:48) However, almost as impressive was the performance of the Fast Sealift Ships which were offloading in the Persian Gulf only 20 days after being ordered into action. (7:60)

Likelihood of War

The linkage of the political, economic, and military conditions is useful in assessing the likelihood of conflict on the peninsula. Is future war likely in this region? Opinions differ. For example, Colonel (Ret) Trevor N. Dupuy recently cited the Korean peninsula as a likely battleground for at least the next few years. Fortunately, his analysis also predicted an ROK-US victory. (8:179-205)

However, for our purposes, the analysis and conclusions will turn on two basic points. First, are there sufficient encumbrances in place so as to deter war? In other words, taken together, do the political, economic, and military conditions work to prevent confrontation and open warfare? Second, are actions underway to reduce tensions in the area, leading to normalization? If there is sufficient deterrence or ongoing actions to reduce tensions, then the likelihood of war is diminished.

Deterrence

Are there sufficient encumbrances or obstructions to deter war? The short answer is that deterrence appears to be working and that the likelihood of war will decrease with time. Militarily, politically, and economically, the balances are all in favor of the ROK. The economic power generated by the ROK has reduced the willingness of the DPRK allies to sanction and support military adventures. (3:262-264)

Militarily, the DPRK and ROK forces are rapidly approaching parity. Within the next few years, the ROK will probably surpass the DPRK in capabilities. While the ROK absolute numbers will probably never equal those of the DPRK, the ROK could win the race by making some qualitative improvements. (10:4-5) The weaponry and training of the ROK forces are more modern, reliable, and devastating. (4:91) The stagnation of the DPRK economy, coupled with the dynamic ROK economy, will only hasten this transition to parity.

The DPRK military is losing capabilities/effectiveness. Military members are increasingly used for construction and other general labor. Additionally, the shortages of materiel and fuel are reducing the capabilities within the military. Counterfeit parts are a common problem. While the parts may be good for commercial uses, they are causing maintenance problems within the military. The reduced fuel deliveries into the DPRK are already affecting civilian life; often street and traffic lights are turned off. The lessening fuel supply will also reduce the motorized options open to the DPRK military. As a result, the capability to initiate a quick thrust into and throughout the ROK is lessening with each passing day. (19:203-209)

The weight of US forces will further tip the balance in favor of the ROK forces. Maintenance of a small force within Korea demonstrates resolve without the threat of offensive actions. The ability of the US to project large forces into a theater was amply demonstrated during Desert Shield/Storm. The distances covered during that operation are comparable to projections into Korea.

Politically, events appear to be moving toward the deterrence of another Korean War. The economic ties between the ROK and China and the former Soviet Union have increased the importance of a stable region to all. (18:252-253) The establishment of full relations between the ROK and the Soviet Union and China is yet another positive sign. (17:70) Access to technology and markets is readily available through the ROK and, as a result, both China and the Soviet Union have served notice that they will not support DPRK military actions against the ROK. To initiate hostilities, the DPRK must be willing to act alone—militarily, logistically, economically, and politically. The DPRK appears reluctant to take such actions unilaterally. (19:203)

Tension Reduction

Are the two Koreas—and the international community—taking actions to reduce tensions and, hence, prevent war? Two key areas that work toward reducing tensions involve diplomatic initiatives and confidence-building measures. While both of these areas are in developmental infancy within the DPRK, the fact is that such efforts have begun. Whether they are ultimately successful at reducing tensions and eliminating the risk of war remains to be seen.

The outreach of the DPRK to other nations is a result of the breakup of communism and the dire DPRK economic situation. Japan and China are emerging as two nations that are developing close ties with both the DPRK and the ROK. Japan has become the DPRK's second largest trading partner behind China. (13:265) The closer linkage of the four major regional powers—China, Japan, the ROK, and the DPRK—is a positive trend toward the reduction of regional tensions.

Both the ROK and the DPRK have initiated a series of confidence-building proposals designed to improve the predictability of actions and to lessen fears on each side. Politically, there have been increasing interchanges between the ROK and the DPRK in attempts to establish more normal political contacts. Economically, the ROK and the DPRK are initiating some preliminary efforts at economic cooperation. The visit of the chairman of the Hyundai Group to the DPRK was an important first step. Trade between the ROK and the DPRK topped $175 million in 1992. (13:265) There have also been increased exchange efforts between the two countries, including cultural efforts in the performing arts, social efforts to reunite separated families, and athletic efforts on soccer teams. (15:19-20)

Militarily, the US presence is increasingly a source of tension to both countries. As the ROK equals the DPRK capability and becomes more confident in its own ability to repel any invasion, force reductions and arms control arrangements on the peninsula will become more likely. Such activities will have a stabilizing effect and will reduce tension. (18:249-251) Both nations have

advocated additional tension-reducing initiatives. The DPRK has proposed elimination of military exercises and arms reduction and control on the peninsula. South Korea has advocated nonaggression pacts, notification of exercises, mutual invitation of observers, etc., to reduce tensions in the region. (15:51) While none of these initiatives have yet borne fruit, the process has begun and, with the help from the other regional powers and the international community, should go forward.

The DPRK nuclear program will be a continuing source of tension in the region. A February 1994 visit to the ROK allowed me the opportunity to gain some insight into this issue. The existence and continued development of the DPRK nuclear program appears to be significant as it affects larger US policy concerns: general regional stability and proliferation issues. A DPRK, armed with nuclear weapons, may cause other nations in the region to consider nuclear programs. Further, as the DPRK becomes more financially strapped, sale of nuclear weapon technology would create proliferation problems throughout the world. However, tension between the two Koreas does not appear to hinge on the nuclear issue. The ROK believes that the North and the South are one nation. Ultimately, reunification is inevitable. The DPRK nuclear program is of concern but should not prevent the march toward reunification. The Neutral Nations Security Commission confirmed this general ROK belief.

Conclusion

Is war likely? Given the changing political and international situation, war on the Korean peninsula appears to be lessening. Deterrence on a military and political level appears to be working. The traditional enemies of the region now have economic ties to all neighbors. Nations within the region increasingly have a commitment toward preventing the outbreak of war. Finally, the initial steps toward closer relations between the two Koreas have been taken. The conditions necessary for regional peace are beginning to develop.

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Lieutenant Colonel Ogan is presently attending the Air War College, Maxwell AFB AL.

The Korean Collocated Operating Base (COB): A Challenging Logistics Concept

Lieutenant Colonel James G. Ford, USAF
Lieutenant Colonel Fred Weller, USAF (Ret)

Introduction

Imagine an Air Force squadron responsible for

- Four Harvest Eagle kits.
- Sixteen housekeeping sets.
- Eight kitchen sets.
- 1,900 vehicles.
- 68,900 short-tons of munitions.
- 93 pieces of aerospace ground equipment (AGE).
- 1,024 pieces of TRAP (tanks, racks, adapters, and pylons).
- Maintenance of 500 buildings.

Welcome to Korea and the Pacific Air Forces (PACAF) version of the collocated operating base or "COB." Yes, this entire laundry list of logistics goodies valued at over $1.4 billion belongs to one squadron; and, yes, it is different! Nothing like this concept can be found anywhere, including the founding father of COBs—United States Air Forces in Europe (USAFE). This paper first explains the COB concept, details the establishment of COBs in Korea, provides the history of PACAF Harvest Eagle kits, describes the role of the 51st COB Support Squadron (COBSS), and then predicts the future of the Korean COBs.

COB Concept

COBs are by no means new. Anyone familiar with USAFE has seen them before. But the Korean COBs are different. First, let's examine a couple of definitions:

a. *Collocated Operating Base* - A COB has traditionally been a base owned solely by the host nation. Generally, an agreement exists at the ministerial level that all or part of the base may be used by USAF forces during wartime. During peacetime, war reserve materiel (WRM) may be prepositioned at the COB, facilities for wartime use by the Air Force may be built, and limited use of the COB for exercises may be authorized. Usually, all facilities at a COB are maintained by the host nation, with accessibility to prepositioned WRM made available to US forces for inspections, inventory, and maintenance. Specific usage is determined at the ministerial level, while deliberate planning for wartime use is done at lower levels. Normally, COBs are "assigned" to active USAF bases for wartime planning, reception planning, WRM prepositioning and maintenance, and similar details. However, there is usually no USAF presence maintained at the COB (permanent party) in peacetime. The bottom line: A COB was originally designed to be a "turnkey" operation.

b. *Standby Base* - A standby base is a base owned by the USAF and maintained by a limited cadre of USAF personnel in a turnkey status. In some cases, there are also host nation forces on the same base which, through an agreement, maintain some or all USAF facilities. Additional facilities required for wartime use can be built on a standby base. WRM can be prepositioned and the base can be used during exercises.

The Korean COBs fit neither the traditional COB nor the standby base description. Suwon, Taegu, Cheong Ju, Kimhae, and Kwang Ju ABs are Republic of Korea Air Force (ROKAF) owned and are identified as USAF beddown bases. Before 1991, the USAF had an *active* operation at Suwon, Taegu, and Kwang Ju, and was a tenant organization on an ROKAF base. However, today, the USAF still "owns" and maintains facilities and shares runways at those bases, but has no US aircraft there. Thus, Korean COBs are a *combination* of both a traditional COB and a standby base.

Establishment of COBs in Korea

In the aftermath of the Cold War, reductions in forces (personnel, areas, and materiel) were inevitable. Congress was no longer in a mood to support a military force on a scale known during the 70s and 80s. Thus, the Nunn-Warner Amendment, which was signed in the late 1980s, sought to reduce the US military presence in all areas of the world.

In the Republic of Korea (ROK), this translated to a reduction of 2,000 personnel for the US Air Force. The US Army's reduction amounted to approximately 6,000 personnel, in addition to US Forces Korea (USFK) being directed to reduce the number of installations on the Korean peninsula. Eventually, Secretary of Defense Dick Cheney announced the reduction of 2,000 US Air Force personnel in Korea and the establishment of COBs to accomplish the reduction while, at the same time, retaining wartime beddown capability.

In September 1989, Headquarters PACAF queried Seventh Air Force regarding a "what if" situation: If the US Air Force established COBs in Korea, what facilities, areas, and materiel would Seventh Air Force want to retain? Likewise, what would be the recommended minimum essential facilities (MEF) for war readiness? In retrospect, it now appears that the Air Staff was already working the issue of COBs in Korea as early as September 1989 and that PACAF's queries were nothing more than fact and opinion gathering to support the Air Staff's studies.

At the same time Air Staff was looking into possibilities, Seventh Air Force took the initiative to control its own destiny. As the agency charged with the responsibility of managing the COBs, it seemed prudent to negotiate a memorandum of understanding (MOU) with the ROKAF that was not "higher headquarters" imposed. Seventh Air Force proposed a draft MOU with rationale that was accepted by PACAF. The draft was presented to the ROKAF and a nine-month negotiation period ensued. To understand the reasons for this lengthy process, it is important to understand the changes that have occurred in Korea.

By late 1989, the Mutual Defense Treaty of 1953 between the governments of the United States and the Republic of Korea was

often viewed by the ROK as a very one-sided document which favored the United States. A subordinate document, the ROK-US Status of Forces Agreement (SOFA) of 1966, was likewise seen as one-sided. Although the United States' presence had already been established under sponsorship of the United Nations, there was a growing resentment—particularly among the younger generation—about continued presence. In short, the negotiations over the COBs soon became a "sovereignty" issue.

Leading to this feeling of sovereignty was the ROK's success in staging the 1986 Asian Games and the 1988 Olympics. These were times when, probably more than ever before, huge numbers of foreigners were present on Korean soil—not as combatants, but as tourists, legitimate business leaders, and official government representatives from all over the world. Most noteworthy, the ROK would be seen by the world as a rising Third World power. The phrase "economic miracle of northeast Asia" was heard and seen in the media. The ROK had come of age!

While PACAF provided guidance by referring to the European "turnkey" system of COBs, the ROK did not understand the European COB system and was not willing to sign a blank check for the maintenance of COBs. It should also be noted that the ROK concept of deliberate planning is far different from the US process. ROKAF negotiators wanted to limit the use of COBs to emergencies and contingencies on the Korean peninsula. The Mutual Defense Treaty, however, was interpreted by the US as one for the preservation of peace and security in the Pacific area. As we could not make the COB MOU more restrictive than the Mutual Defense Treaty, this led to an impasse in the negotiations that was eventually broken by direct intervention at the general officer level.

With this intervention, the COB MOU was concluded in March 1991. It established five collocated operating bases in Korea and defined a COB as "a Korean Air Base without a permanent USAF operational unit during peacetime." Additionally, it required the USAF to return excess facilities and areas in accordance with the SOFA and also required both parties to enter into subordinate agreements, called Technical Arrangements (TAs), which have not yet been concluded. These TAs will (1) designate the facilities and areas to be retained by the USAF and those to be returned to the Republic of Korea in accordance with Articles II and IV of the SOFA; (2) establish specific support responsibilities; (3) designate combined-use facilities and areas; (4) designate facilities and areas reserved for the exclusive use of USAF forces; and (5) permit authorized members of the US Armed Forces and Civilian Components access to COBs.

The COB MOU has a life of six years, after which it may be extended if both parties agree. However, we still face many challenges!

History of the PACAF Harvest Eagle Kits

PACAF's history of air mobile bare base support began during the Korean War. PACAF was a leader in developing the insertable squadron-sized mobility kits. Modifications were frequent during the early years until the kits were more easily movable by air. The Grey Eagles, as the early version of Harvest Eagle was known, were subsequently used in Vietnam and Cambodia. Since then, the bare base support concepts have undergone many more changes and modifications. After Vietnam, the kits were prepositioned in the Philippines, then Japan, and now the Republic of Korea.

Upon being placed in the ROK, the kits became the responsibility of Detachment 2, 314th Air Division—a direct reporting unit to Fifth Air Force. When Seventh Air Force was reactivated in 1986, direct management responsibility for the kits was given to the 6314th Support Flight. At that point, the unit's responsibilities increased to include the management of housekeeping and kitchen sets. During the Team Spirit '89 exercise, the unit tested the field combat support capability of the Harvest Eagle kits for the first time. Those test results have since become the baseline for the PACAF bare base support concept and have helped determine kit funding priorities. At present, the Harvest Eagle package consists of kitchen sets, housekeeping sets, and sleeping tents designed to support 1,100 personnel at four different locations, or 4,400 personnel at one location. A package is air transportable and is Air Staff controlled as WRM assigned to certain MAJCOMs.

The concept of WRM management increased to include aerospace ground equipment, munitions, vehicles, and real property. This increase in responsibility resulted in the 6314th Support Flight redesignation as a squadron, eventually transferring to the 51st Fighter Wing and becoming the 51st COBSS.

51 COBSS

The 51st COBSS is very complex. Its mission is to oversee the maintenance of facilities and WRM assets which facilitate the rapid reception of forces deploying to predesignated collocated operating bases. The squadron has approximately 100 personnel widely dispersed throughout the Korean peninsula at six locations. The Headquarters is at Osan AB, and the COBs are at Suwon, Taegu, Cheong Ju, Kimhae, and Kwang Ju—all Republic of Korea Air Force bases. The squadron has a $20 million annual operating budget, and the 100 personnel comprise 21 career fields. Their specific duties are:

(1) To oversee a local national contractor who maintains facilities to USAF standards.

(2) To maintain WRM equipment so it will work if/when needed.

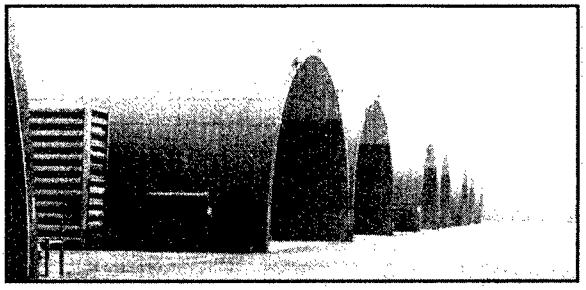
(3) To maintain Harvest Eagle assets (tentage, kitchen, and housekeeping) so they do not deteriorate.

(4) To maintain aircraft tanks, racks, adapters, and pylons for operational commitments.

(5) To maintain vehicles prepositioned at the COBs for immediate use in the event of emergencies and exercises.

A Look to the Future

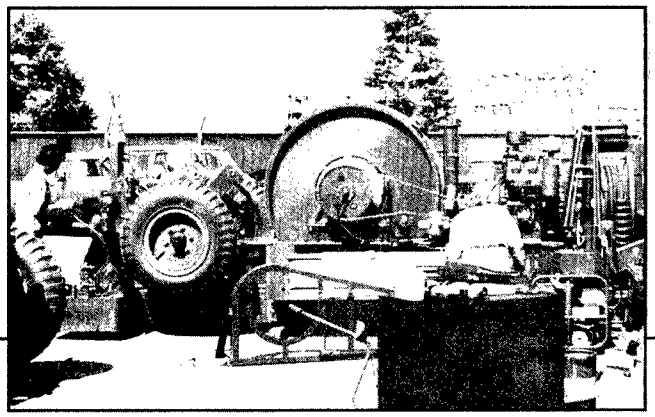
As long as US presence in Korea is required, the USAF needs to continue to exercise at COBs—this is a major tenet of the Korean COB system. In the past two years, we have exercised each COB at least once with the exception of Cheong Ju (a bare base where exercise costs would be prohibitive). There have been some problems, but they are workable. For example, when a base like Kwang Ju had an active USAF presence (before 1991), augmenting units frequently exercised there. They took advantage of the infrastructure already in place (security police, aircraft maintenance, billeting, food service, etc.). With the conversion to COB status, these services are no longer present. This results in the exercising units often being required to bring their own support, a situation which increases exercise costs. The advent of the two-part Base Support Plan as part of the deliberate planning process eases this problem somewhat. Part One identifies the capabilities, limitations, and constraints of the

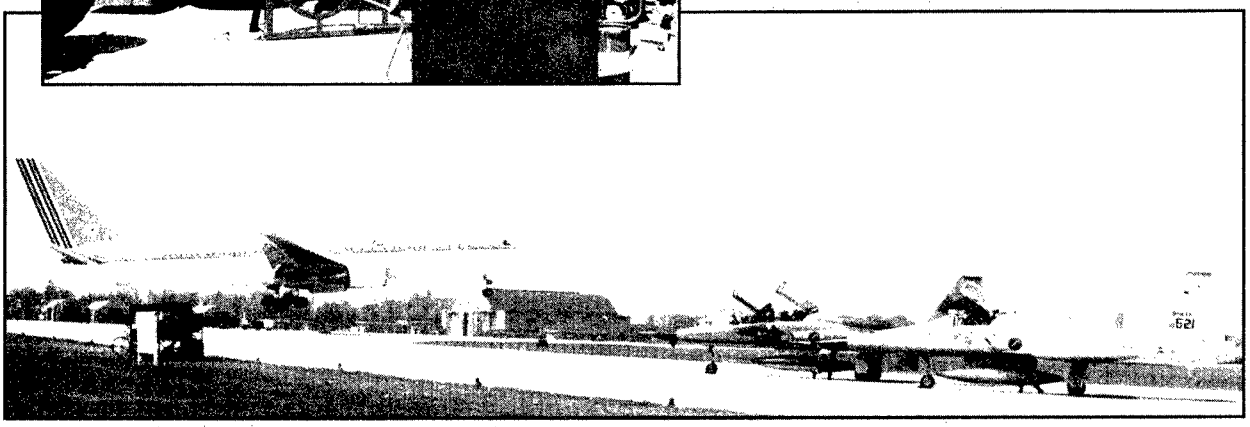


Aircraft Refueling Flow-Throughs Stand Ready at Suwon

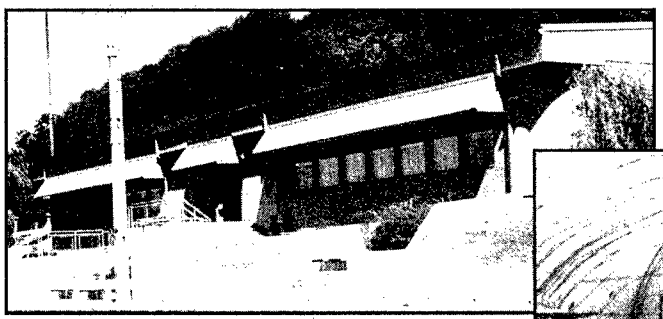
ROKAF Security at the COBs

Korean Contractors Maintaining USAF WRM

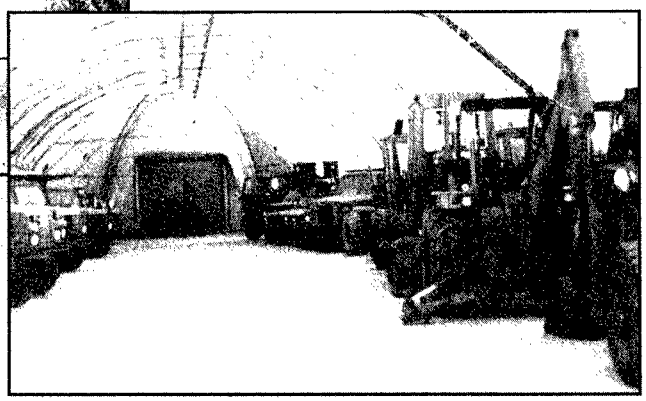




Increasing Commercial Presence at Most of the COBs



Dining Facility in Mothballs at Taegu



WRM Vehicles Stand Ready at Kwang Ju

base, and Part Two supplements them. Even with existing problems, however, COBs represent a golden opportunity for designated augmenting units to learn about their beddown base—what capabilities and problems they present. The interaction with their Korean counterparts will be invaluable if/when a contingency requires deployments to the Korean peninsula.

Lieutenant Colonel Ford is presently Commander, 51st COB Support Squadron, Osan AB, Korea. Fred Weller is Political/Military Affairs Officer, Seventh Air Force, Osan AB.

Most Significant Article Award

The Editorial Advisory Board has selected "Agile Logistics: The Art of Logistics in the Twenty-First Century" by Keith Shelton and David Davenport as the most significant article in the Fall 1993 issue of the *Air Force Journal of Logistics*.

Most Significant Article Written by a Junior Officer

The Executive Board of the Society of Logistics Engineers (SOLE) Chapter, Montgomery, Alabama, has selected "A Neural Network Approach to the Inventory Range Problem" (Fall 1993), written by Captain Steven B. Reynolds, USAF, in collaboration with Wayne B. Faulkner and Robert E. Smith, as the most significant *AFJL* article written by a junior officer for FY93.

Student research is a key component of the AFIT School of Logistics and Acquisition Management graduate programs. All students, working either alone or in teams of two, complete a master's thesis. Many of the thesis research efforts are sponsored by agencies throughout the Department of Defense. This issue highlights the superior thesis research efforts produced by the class which graduated in September 1993. A copy of each thesis is available through the Defense Technical Information Center (DTIC).

AFIT Commandant's Award (Most exceptional research contribution to the student's field)

TITLE: *An Analysis of the Impact of Using Different Sources of Demand Data for Mobility Readiness Spares Package Computations*

AUTHORS: Captains Rudolph Turco and John Jones

This study investigated the impact of using exercise and deployment demand data for the requirements computations of Mobility Readiness Spares Packages (MRSPs). The study focused on B-52G electronic countermeasures components in the current MRSP authorization listing. Demand data were collected from the Bull Rider exercise, two Green Flag deployments, and combat missions during Desert Storm. The methodology utilized the design of nine mission profiles based on past requirements and probable future requirements. Using the Dyna-METRIC Microcomputer Analysis System (DMAS) software package, the researchers computed separate MRSP requirements for each of the nine scenarios using both the exercise data and the Weapon System Management Information System (WSMIS) computation data. The actual Desert Storm demand rates were used in the assessment of combat capability for each MRSP. The results indicated a marginal advantage in the combat capability of the D041-computed MRSPs for the nine mission profiles. However, when MRSP package cost was considered, the exercise demand-driven MRSPs were significantly more advantageous, resulting in average savings of over $77 million with minimal impact to capability.

Leslie M. Norton Pride in Excellence Award (Outstanding quality) - six 93S recipients

TITLE: *An Analysis of the Impact of Using Different Sources of Demand Data for Mobility Readiness Spares Package Computations*

AUTHORS: Captains Rudolph Turco and John Jones (See AFIT Commandant's Award for thesis abstract.)

TITLE: *Contracting for Scheduling Performance: The Relationship Between Pre-Contract Award Management Actions by the DOD and the Resultant Schedule Performance*

AUTHORS: Squadron Leaders Richard Hazeldean and John Topfer

This research focused on the pre-contract award management actions of small-scale design and development contracts and the relationship of these actions to schedule performance. The study also presented the planning, specifying, and controlling phases of the contractual process. The researchers obtained samples of 25 contracts from system program offices (SPOs) at Wright-Patterson AFB. Data on the variables were obtained directly from the contract files and from the contract-management database, the Advanced Management Information System (AMIS). Regression analysis techniques were used to identify the pre-contract award management actions that were related to schedule performance. The number of contract modifications was found to be the most significant factor related to schedule performance. Pre-contract award management actions, showing a significant relationship to schedule performance, were based on whether the contract was prescheduled, whether the contract involved concurrency, whether a preliminary work breakdown structure (WBS) had been developed, whether the contract used a Type A or Type B specification, whether the contract required the schedule information to be presented in network format, and whether the number of data item descriptions (DIDs) were specified in the Contract Data Requirements List (CDRL). In addition to the identification of these actions, the study revealed that schedule management was not well understood within the SPOs.

TITLE: *How Effective Are Anti-Virus Toolkits in Preventing Computer Virus Attacks?*

AUTHORS: Captains Leroy Pedone and Kevin Ziese

The technical literature is filled with examples of the many methods that can be used to prevent computer virus attacks. However, to date, limited basic research has been undertaken to quantify the effectiveness of the various approaches. The predominant approach is to install an anti-virus toolkit to prevent computer virus attacks. The typical anti-virus toolkit is composed of loosely integrated software components designed to detect and remove computer viruses. These toolkits traditionally favor *a priori* methods designed to detect known computer viruses, with some products also providing *a posteriori* methods designed to identify the symptoms of a computer virus attack, presumably when the *a priori* methods have failed. The focus of this research was to establish the actual effectiveness of a judgmental sample of anti-viral products when applied against a random sample of computer viruses that were collected from a certification testbed, underground bulletin board systems (BBSs), and several computer virus construction kits. Using contingency table analysis, hypothesis testing, and the Chi-Square Goodness of Fit Model, the research established the measures of effectiveness for the pooled sample of products by statistically adjusting the experimental results to remove the effects of random sampling variance and determine the true effectiveness of the sampled products. The research also addressed the inadequacies of existing product effectiveness studies and offered a rigid experimental methodology to replace current *ad hoc* approaches. Since anti-viral products are an integral part of the US Air Force's computer virus countermeasures program, the research also offered suggestions on how to assimilate our experimental findings into the Air Force Computer Security Program.

National Contract Management Association (NCMA) Award (Significant contribution to contract management techniques)

TITLE: *Measuring Productive Efficiency in Air Force Operational Contracting Squadrons: A Data Envelopment Analysis Approach*

AUTHORS: Captains Dennis Groseclose and Douglas James

In an effort to improve the management feedback in operational contracting squadrons, this research concentrated on the development of an alternate method to measure operational contracting performance. Specifically, the research investigated the use of data envelopment analysis (DEA) to measure the productive efficiency of 45 operational contracting squadrons. Operational contracting managers were surveyed to identify critical resources to, and outputs from, the contracting process. Based on this survey, four inputs and five outputs were included in the DEA model. The DEA was executed for each contracting squadron under study. The DEA output provided improved performance measurement and feedback information. DEA combined multiple inputs and outputs into a single measure of performance. Because it allowed flexible weighting of decision variables, DEA accounted for differences in squadron size, mission, and purchase complexity. By examining the DEA-generated Hypothetical Comparison Unit, specific input reductions and output increases were established for each relatively inefficient squadron. Finally, the DEA output addressed several desired characteristics of a performance measurement system identified by contracting managers.

In addition to the thesis awards, non-thesis awards are also presented:

Society of Logistics Engineers (SOLE) Excellence in Logistics Award (Superior academic record and contributions to the field of logistics)

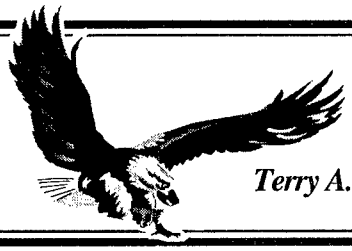
TITLE: *Benchmarking Practices of Air Cargo Carriers: A Case Study Approach*

AUTHORS: Captains Mila Abalateo and Joni Lee

This research effort used the benchmarking process and a case study methodology to determine what the Air Force can learn from commercial air cargo carriers. A literature search showed that the US air cargo industry leaders are United Parcel Service, Federal Express, Emery Air Freight, Airborne Freight, DHL Airways, and Burlington Air Express. In addition, the 436th Aerial Port Squadron at Dover AFB, Delaware, was chosen as the Air Force representative in the benchmarking study. Observations of air cargo operations and interviews with operational managers or applicable experts familiar with air cargo operations were conducted at each carrier's hub and at Dover AFB. Observations revealed that the Air Force can learn from the commercial air cargo carriers in four areas: cargo handling equipment, intransit visibility, operations interface, and safety. Observations and responses to interviews also revealed disparities between the mission of the Air Force and the goals of the industry leaders. Therefore, a majority of the industry leaders' practices during surge periods cannot effectively be applied to the Air Force.

The Graduate School of Logistics and Acquisition Management invites suggestions and topics for thesis research in its Master of Science (M.S.) programs. Specific areas covered by these programs include logistics management, acquisition logistics management, supply management, maintenance management, transportation management, systems management, contracting management, cost analysis, software systems management, and information resource management. If you have a thesis topic to suggest, please contact a faculty member to discuss the topic first. Any faculty member may be reached by calling DSN 785-7777, Extension 3300, or Commercial (513) 255-7777, Extension 3300. Thesis research topic proposals should be submitted to Lt Col Jacob V. Simons, Jr., Assistant Dean for Research and Consulting, AFIT/LA, 2950 P Street, Wright-Patterson AFB OH 45433-7765 (DSN 785-7777, Extension 3312). For a copy of the Call For Theses which details the thesis topic suggestion process, please contact Lt Col Simons.

Air Force Base Conversion: Environmental Challenges and Opportunities



Terry A. Yonkers

Introduction

Less than seven years ago, few envisioned the profound changes in world events that would lead to the radical downsizing of the Department of Defense. As part of the overall plan, the Air Force is reducing its active forces, eliminating air wings, realigning others, and closing installations no longer needed.

Not since Robert McNamara was Secretary of Defense has such a large-scale base closure and property disposal effort been undertaken. Disposing of bases 30 years ago was difficult enough. Today, these efforts are complicated by a number of environmental rules and regulations; for example, the National Environmental Policy Act (NEPA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or "Superfund" Act), and the Community Environmental Response Facilitation Act (CERFA).

At the same time, there appears to be a pot of gold at the end of the rainbow with President Clinton's Five-Part Plan announced in July 1993. For the first time, there is a national policy aimed at accelerating environmental cleanups at closure bases, creating jobs by converting military installations to commercial reuse, and cutting bureaucratic red tape. This new political and legal climate presents a number of challenges, as well as unique opportunities, for the Air Force Base Conversion Agency (AFBCA).

AFBCA: Who Are We and What Do We Do?

Though in existence since 1990, the Air Force Base Disposal Agency was formally established in November 1991. The name was changed to "Conversion" Agency in December 1993 to fall in line with the President's Five-Part Plan, which emphasizes redevelopment and job creation at closure bases rather than just disposal of surplus federal property. AFBCA is a functional operating agency of the Office of the Secretary of the Air Force for Manpower, Reserve Affairs, Installations, and Environment (SAF/MI). We are the Air Force's execution agent for disposing of property at bases closed under the Base Realignment and Closure Act of 1988 (Public Law 100-526) and the Defense Base Realignment and Closure Act of 1990 (Public Law 101-510).

The Agency's objectives are basically threefold:

(1) Make property available to local/state redevelopment authorities at the earliest possible time and in a manner consistent with their needs and reuse plans.

(2) Complete fast-track environmental cleanups to be able to convey property.

(3) Reduce federal outlays as a result of operating and maintaining facilities at closure bases.

Environmental cleanup is an integral part of accomplishing these objectives. It is often, however, the major impediment to disposing of property by deed in a timely manner.

Environmental Challenges and Opportunities

In 1993, the Air Force commissioned the MITRE Corporation to develop a flow diagram of the property transfer process. The resultant diagram consisted of 330 separate steps, many of which were needed to comply with three federal environmental laws: NEPA, CERCLA, and CERFA.

NEPA requires federal agencies to analyze the environmental impacts of their proposed actions. Disposal and reuse of property at closing bases is an action which requires an Environmental Impact Statement (EIS), with the EIS process culminating in a Record of Decision (ROD). By law, properties cannot be conveyed until the ROD is signed by the Air Force.

While NEPA has been in effect for 25 years and most of the "bugs" in the process have been worked out, it still takes about 18 months to work through an EIS and disposal and reuse ROD. Further, because the process is open to judicial scrutiny, if we do not fulfill the procedural requirements of the law, there is always the possibility that we may be enjoined from implementing the ROD which would further frustrate redevelopment objectives.

CERCLA deals with the investigation and remediation of sites where there has been a release of a hazardous substance. CERCLA was amended in 1986, and Section 120(h) of the Act specifically prohibits the transfer of federal property until all remedial actions necessary to protect human health and the environment with respect to any hazardous substance remaining on the site have been taken and are operating properly and successfully. While the meaning of the law seems straightforward, its application is frequently complicated by differing opinions as to what constitutes "protection of human health and the environment." These decisions ultimately reside with federal and/or state environmental regulators. Hence, in large part, they control the remedial process, not the Air Force.

Such divergent views are usually not satisfied until the end of the process which, for complex sites such as those with ground water contamination, may take 10-15 years. Unfortunately, the properties in greatest demand for redevelopment are those where most industrial-type activities occurred and where subsurface or ground water contamination is most likely; for example, engine maintenance shops, plating shops, corrosion control facilities, and fuel storage and distribution systems—those facilities in and around the flight line.

Because the Section 120(h) provision of CERCLA generally prevents transfer of property by deed early, the Air Force developed the concept of using interim out-leases, which allows for most redevelopment until environmental cleanups can be accomplished. Unfortunately, interim leases are less than optimal. Developers do not like them because financing for redevelopment is difficult to obtain without a long-term interest in the property and interim leases are generally for one year with year-by-year renewals. This option is not optimal for the Air

Force either because, as landlord, we must expend government funds to operate and maintain the facilities when they are not being leased. Further, if the property is to be used for industrial operations, the government may incur environmental liabilities as a result of spills or releases of hazardous substances by the lessee.

CERFA is a new law passed by Congress in October 1992. It was conceived as a means to convey property rapidly by identifying "uncontaminated" parcels which would not be encumbered by the provisions of CERCLA Section 120(h). The essence of the process is the preparation of a comprehensive environmental baseline survey (EBS), which relies on existing information (augmented by interviews with former employees, title series inspections, and physical and visual facility inspections) to document that no release, storage, treatment, or disposal of hazardous substances or petroleum products has occurred on the property. Such a determination qualifies the property as "uncontaminated," and it can be conveyed by deed at any time. The "kicker" is the requirement to obtain state and/or US Environmental Protection Agency (EPA) concurrence on the Air Force's determination of uncontaminated parcels.

As with the CERCLA, the intent of the new law seems straightforward, but its application is mired down in technical arguments and uncertainties. A case in point is Bergstrom AFB, Texas. When provided with the completed EBS and a request to concur on the uncontaminated parcels, the Texas Department of Natural Resources Conservation (DNRC) replied with a nonconcur for the entire base. Its position was based on the argument that the Air Force had not sufficiently characterized the ground water contamination which is known to exist under at least some portions of the installation. They were concerned that the state could be held liable if it concurred, the property was subsequently deeded, and the new owner became exposed to unknown environmental hazards at some later date.

A valid argument? Perhaps, if the focus is strictly on theoretical legal liability clauses. But the unfortunate consequence of the state's position is that it delays the transfer of property until there is complete certainty that no hazard exists. This is hardly what Congress intended in passing CERFA. No matter how much time, effort, and money are expended, we will never reach total certainty. Our options, then, are (1) try and convince the Texas DNRC to take a more "risk-based" approach to this situation while reiterating that existing law provides the necessary liability waivers; (2) fully characterize the ground water contamination to the state's satisfaction and use our lease option in the interim; or (3) accept the state's nonconcurrence decision as the conclusion of the CERFA process. In the latter case, the property still can be deeded as soon as all necessary remedial actions on it have been taken within the meaning of Section 120(h).

What are the opportunities?

So far, I have described the major environmental challenges of the base conversion business. What about the opportunities? Certainly, the President's Fast-Track Cleanup initiative (one part of his Five-Part Plan) opens the door to new and innovative approaches. The cornerstone of the initiative is the creation of a Base Realignment and Closure (BRAC) cleanup team (BCT) at each closure base composed of three members: one from the Air Force, one from the state, and one from EPA. The teams are to be empowered to make decisions with regard to creative and cost-effective ways to get cleanups done quickly, yet, in a manner which is protective of human health and the environment.

The President's Plan has already had positive impact. First, it has forged a new relationship between DOD, EPA, and the states, one that is open and cooperative, rather than adversarial. A trust is building at many of the closure installations that will lead to less bureaucratic posturing and better and more timely solutions to problems.

Second, we are seeing adoption of common goals and objectives by all stakeholders. It has been uncommon, heretofore, for the regulators to embrace the goal of targeting cleanup priorities as a means to make property available for transfer. Traditionally, their focus has been on protection of human health and environment to the exclusion of other social goals.

Finally, and most importantly, the President has emphasized a "commonsense" approach to environmental cleanup and a marked departure from "business as usual." As a result, we are beginning to see the traditional (complex, costly, and bureaucratic) approaches to cleanup supplanted by more commonsense strategies. A good example is the adoption of "presumptive remedies" for those sites where the contamination and geological conditions are similar.

At Williams AFB, Arizona, for instance, there have been a number of fuel spills contaminating subsurface soils and ground water. Rather than developing separate Feasibility Studies (FS) which would lead to similar remedial conclusions, the remedy is "presumed" to be the same for each fuel spill site. Following this approach, the Air Force can avoid the lengthy Feasibility Study step, build on existing remedial designs, and move quickly into the actual cleanup. As a result, the process is shortened, costs are reduced, and a quality cleanup is achieved. At the same time, this approach also benefits the EPA and the state by optimizing the resources they would otherwise use to review FSs and oversee cleanups.

Ultimately, the taxpayer is the beneficiary and with US expenditures for environmental protection (public plus private) this year likely exceeding those for defense, it is incumbent upon employees at every level of government to seek the most cost-effective solutions to cleanup.

Where do we go from here?

Under the 1990 statute, one more BRAC Commission will convene in 1995. Some believe the recommendations from this final Commission will result in more closures than any of the previous three. This being so, there will be an even greater demand to transfer property to communities for redevelopment.

The 330-step process which must be completed before the Air Force can transfer properties is both cumbersome and time consuming. One of AFBCA's objectives, therefore, is to streamline this complex property disposal process. We will continue to work with the Office of the Secretary of Defense (OSD), congressional staffs, and other federal agencies to identify where legislative or internal procedures can be changed to simplify and accelerate the process.

From the environmental perspective, there are many ways to arrive at satisfactory solutions to cleanups that both protect human health and the environment and get the job done faster and for less cost. The partnerships we are forging with the EPA and the states hold much promise. We all realize, I believe, that the current way of doing business can be improved; and I see a true commitment and willingness to do exactly this.

The President set the stage for such changes in his Five-Part Plan. Our intent is to press for change. Every taxpayer and community across our nation will ultimately benefit from the success of these endeavors.

Terry Yonkers is presently Chief, Environmental Programs, Air Force Base Conversion Agency, Arlington, Virginia.

Environmental Issues Involved in Painting Aircraft

Captain Edward. C. Stalker, USAF

Introduction

The basic concept of paint, as a protective coating for structures or vehicles, dates back many centuries. Military aircraft paint is a protective coating in more than one sense of the term. It not only protects the vehicle's structural components from corrosion, but also makes it difficult to detect visually, on radar, or by infrared.

Paint is a very old and well-developed technology. The basic idea is very simple: a solid pigment is dissolved in a solvent, and the mixture is applied to a surface. The solvent evaporates, and the solid pigment remains as a very thin coating over the surface. The solvent may be something as innocuous as water; for example, latex paints.

Environmental Hazards of Painting

Most aircraft paints use solvents such as methyl-ethyl-ketone (MEK) or various types of xylene compounds. Most aircraft paint solvents are volatile organic compounds (VOCs), greenhouse gases, ingredients in photochemical smog, or ozone depleting compounds (ODCs). VOCs can damage the liver, kidneys, and lungs. They pose a severe health risk to paint personnel. In the environment, long-term, low-level exposure can cause cancer in adults and damage developing fetuses. Additionally, the pigments used on military aircraft often contain chromium or cadmium; and they produce the yellow, green, and blue colors that are predominant on our aircraft.

Paint does not bind directly to aluminum. It is first necessary to use a primer (a specially formulated paint that is applied to the aluminum). Paint will adhere to primer which is usually formulated with anticorrosion properties. These anticorrosive properties are usually composed of chromium and cadmium compounds. Unfortunately, chromium and cadmium are heavy metals which can cause liver, kidney, and bone marrow damage. They can also create severe health risks for our paint personnel and severe pollution problems if they escape into the environment.

DOD has been studying ways to reduce these risks for many years. The traditional way to manage these risks is by putting paint personnel in protective suits and full-face respirators. Paint hangars use air-exhaust filtration extensively, and personnel carefully gather and dispose of liquid wastes. Theoretically, this approach should handle the problems. In reality, Murphy's Law comes into play frequently.

Environmental Hazards of Paint Removal

Paint must periodically be removed from aircraft in two ways: chemically or mechanically. Chemical solvents are environmental hazards in their own right, and they chemically "poison" the primer surface so paint will not adhere to it. Mechanical removal is done by abrasion: aluminum oxide, silicon carbide, plastic media, CO_2, water, ice chips, starch, baking soda, and steel shot. Most of these techniques remove some of the primer layer as well as the paint. This necessitates full removal down to the metal and reapplication of the primer.

There are some techniques that do not require abrasion or solvents, such as microwave, laser, or xenon flash lamps which are very slow, expensive, and energy-intensive. There is some research being done on hybrid systems; i.e., using a weak solvent to prepare the surface for a less-aggressive abrasive removal technique.

Approaches to Reduce Environmental Hazards in the Paint/Depaint Process

There have been many research studies to eliminate/reduce environmental hazards. The two main efforts seem to lie in changing the ingredients in the paint mix and in using another coating technology other than paint.

Reducing Solvent Use

Solvents have three uses in the painting process: as a removal agent, as a carrier for the primer, and as a carrier for the paint pigment. As stated before, most paint solvents are health and/or environmental risks. Some of the methods being investigated to reduce solvent use are:

High solids polyurethane paint. The ratio of pigment to solvent is increased in this type of paint, which then reduces the total volume of solvent used. This is a successful program; it has reduced solvent use and air emissions dramatically at many facilities. However, it requires new equipment, retraining, and close control of temperature, dust, and humidity. In addition, it has a limit; increase the ratio too high, and the paint/primer is ineffective. The benefit is this method can bring a facility into compliance for the near term. Environmental regulations are presently getting tighter, and this trend is expected to continue 15-30 years down the road.

Self-priming topcoat (SPT). The Navy developed this paint, which is essentially an anticorrosion primer and paint in one product. It reduces the use of solvents by 50%, simply because paint personnel make only one pass instead of two. The Air Force Materiel Command (AFMC) is presently testing it, with conflicting results; so further study is needed.

Benign solvents. Common household latex paint uses water as its solvent. The pigment oxidizes to form a watertight coating. There has been some work with water-based and alcohol-based paints. These paints do not seem to stand up to the demands of aircraft exteriors.

Benign pigments. There are paint pigments that do not contain hazardous materials. Good substitutes have been found for most shades of blue, red, and white. Unfortunately, yellow usually involves chromium oxide. Yellow is needed to make green, the predominant color in Air Force paint schemes.

Benign anticorrosion compounds. Research is being conducted to find good substitutes for the heavy metals in present primers. So far, none of them have satisfied Air Force requirements.

Alternatives to Paint

The other approach to reducing or eliminating environmental risks is to step out of the basic "paint concept" and look for a reliable technique that will meet the operational requirements without causing environmental hazards.

Powdered plastic coatings The best known of these processes is called "Flame-Spray." It is presently being studied by the Corrosion Control Center, Warner Robins Air Logistics Center (WR-ALC), Robins AFB, Georgia. Despite the name, it is not as dramatic as one might think. It can be applied to a paper towel without damaging it. It is resistant to impact, and most fuel lubricants and hydraulic fluids and solvents. Its chief drawback is that it can exhibit "thermal creep" at temperatures above 180 degrees. Presently, it looks as though it will be good for aerospace ground equipment (AGE) and munitions, but not aircraft exterior surfaces.

Aircraft film. This technology involves the use of an adhesive-backed sheet of plastic. The concept was developed from our present system of aircraft decals. US Air has used this technology since 1981. Their paint scheme involves a large blue and red stripe that runs the length of the aircraft, and covers the entire horizontal stabilizer and rudder. In 1992, United Airlines (UAL) became interested in this process. The results of their Paintless Aircraft Project are summarized in the attached case study. (NOTE: In 1992, the Air Force Logistics Management Agency (AFLMA) was tasked by the Director of Maintenance, Headquarters USAF, to visit UAL and look at these project results.)

Summary

The Air Force cannot go back to the unpainted "shiny metal" color scheme of the 50s and early 60s because unpainted metal presents an excellent target for thermal imaging systems. For corrosion protection reasons, we must continue to put a protective coating on our aircraft. There are several ways that we can reduce the environmental impact of this coating process. This article has presented some of the issues and some of the possible alternatives.

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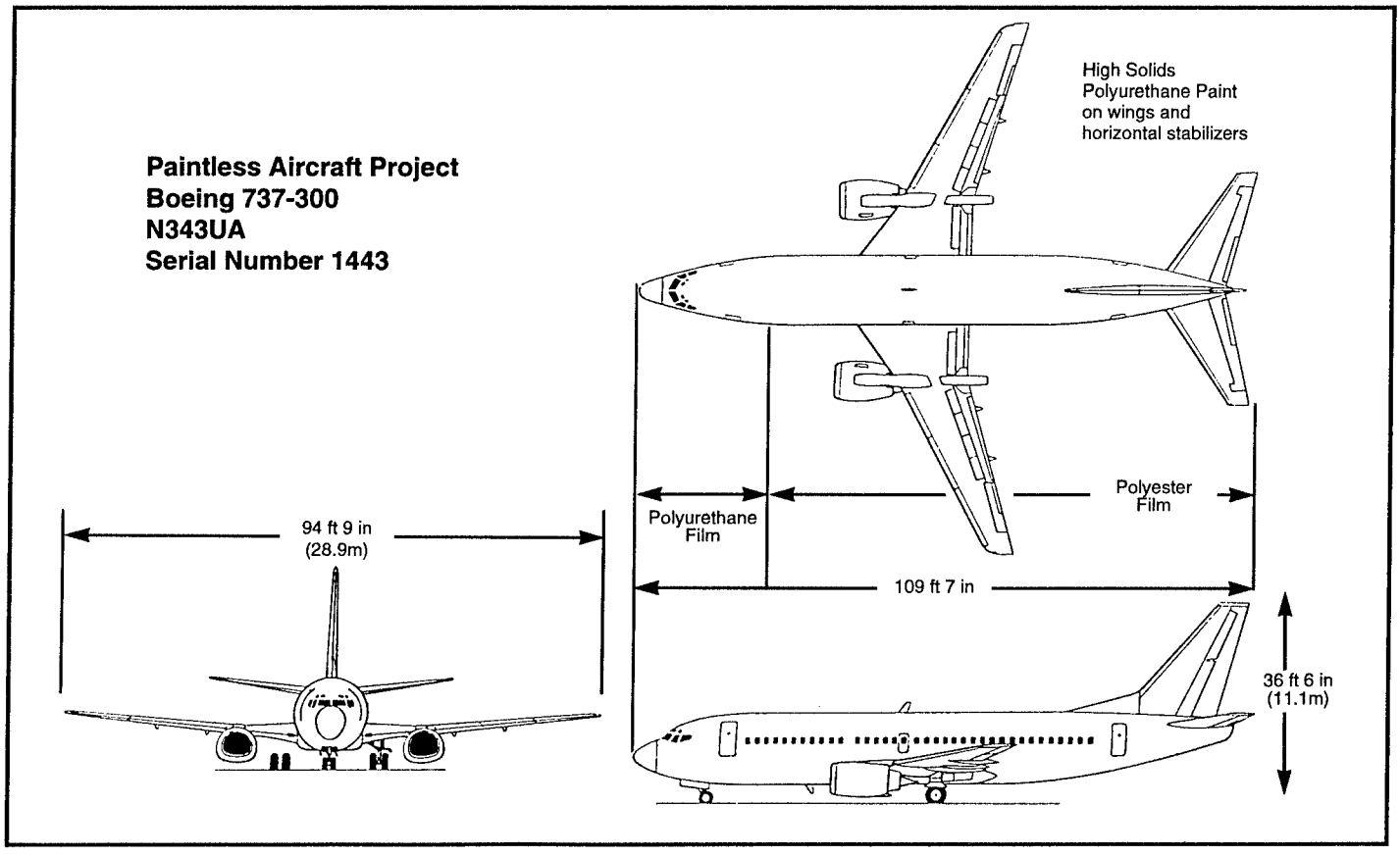
Captain Stalker is presently Environmental Issues Project Manager, Maintenance and Munitions Division, AFLMA, Gunter Annex, Alabama.



CASE STUDY:

THE USE OF ADHESIVE-BACKED PLASTIC FILM ON AIRCRAFT

Commercial airlines face many of the same environmental problems as DOD. One of the biggest problems is paint procedures. Airlines have learned to minimize the use of heavy metal pigments in their paint schemes. The next time you go to an airport, notice the lack of yellow or green in airline paint schemes. In addition, they are presently using many of the same solvent reduction processes that the Air Force uses. However, they still tend to come up against the same problem: paint technology can only be "cleaned up" to a certain point before the paint can no longer do its intended function.

The AFLMA team members looked at the Delta, US Air, and United Airlines (UAL) heavy maintenance facilities which are roughly equivalent to an Air Force Air Logistics Center (ALC). At Delta and UAL, their paint procedures were much the same as the Air Force. At US Air, we found a radically different situation.

US Air has minimized the use of paint on their aircraft. Since 1981, they have used an adhesive-backed plastic material, rather than paint. The material was developed from the material used to make decals. It might be easy to visualize this technique as an "enormous decal." We refer to this process as Alternative Surface Finish (ASF).

ASF is applied with a soap-and-water solution. Since it has no fumes or vapor hazards, it can be applied in a shirt-sleeve environment. It can also be cut and formed with ordinary scissors or razor blades and must be applied between 55 and 105 degrees Fahrenheit. Although input air filtration is not required, extreme dust conditions can affect adhesion. At US Air, it is applied in a regular maintenance hangar—not a specialized facility.

The Paintless Aircraft Project

The California Environmental Protection Agency (CALEPA) is paying very close attention to UAL's air emissions and solid and liquid wastes from paint operations at their maintenance facility in San Francisco. The cost of complying with the California environmental laws is steep, but the penalties for noncompliance are even worse. Much of the hazardous waste (HW) produced at the facility was a consequence of the paint/depaint operations. UAL saw ASF as a way to avoid using paint which would eliminate the occupational health and environmental headaches and still meet operational requirements.

In July 1992, UAL representatives met with personnel from the 3M Corporation to discuss the possibility of using ASF instead of paint on their aircraft. The Paintless Aircraft Project began in October 1992, with the application of ASF to a Boeing 737-300. The aircraft was flown for 13 months on a heavy schedule and averaged over 110 flight hours per week during this test.

Types of Film

Three types of plastic films were used on this aircraft:

(1) A clear polyurethane boot which was applied to the radome.

(2) Sheets of polyurethane film, in the UAL colors, which were applied to the nose of the aircraft, to a point just aft of the forward entrance. Polyurethane film is used on the nose, because it is more flexible and resists impact well. This material is derived from the polyurethane leading-edge tape used on the F-14, F-15, F-16, and F-18.

(3) Sheets of polyester film which were applied to the remainder of the fuselage and empennage. Because the aircraft is pressurized, these sheets must be perforated every 0.25 inch to allow air to escape. This film is lighter and cheaper than the polyurethane film. It is the predominant material used on the aircraft.

Polyurethane radome boot. The radome boot was an unqualified success. Appearance is a valuable quality for commercial airlines. The radome paint usually begins to chip within months of being repainted. UAL was so pleased with the radome boot that they have decided to use it on all their aircraft.

Polyurethane film. The polyurethane film on the cockpit area began to peel away from the aircraft after a month. About one square foot of polyurethane came away from the aircraft while it was making a night approach into Caracas, Venezuela. 3M technicians replaced the polyurethane with a new batch, but this adhesive also failed. In March 1993, UAL decided to totally remove the polyurethane and replace it with polyurethane paint.

Laboratory examination found that the adhesive had reacted with the chromate ions in the electrochromate conversion coating (Allodine 1000.) This had caused it to lose adhesion to the polyurethane film.

Polyester film. The polyester film on the rest of the fuselage functioned well. There was some "bubbling"; air leaking from the pressurized cabin caused the film to lift up. The perforations are spaced 0.25 inch apart to prevent this. In the areas where bubbling occurred, AFLMA personnel found that the adhesive had plugged the hole. This was caused by repeated application and removal of the film by inexperienced personnel during the training process. In any event, the problem was easy to fix: simply poke the holes clear with a pin or paper clip and then smooth out the bubble. The polyester was also sensitive to impact and chipped away around the cargo doors. However, the film was easy to repair. Maintenance personnel simply cut away the affected area, laid a patch on it, and then smoothed it. As long as the air temperature was above 55 degrees Fahrenheit and the humidity was below 90%, this repair could be, and was, done outdoors during overnight layovers.

The biggest problem came during the removal of the polyester film. The new adhesive reacted with the chromates and the polyester film. The film came up easily enough, but the adhesive remained on the aircraft. It had to be removed with a solvent containing an environmental hazard. 3M is working hard to develop a good replacement for the adhesive.

Although UAL had problems with both the polyester and polyurethane films, they are continuing a study of these materials. They plan to "patch-test" new samples of the films and adhesives until 3M comes up with a combination that meets their operational needs.

Air Force Use

Air Force needs are somewhat different from the commercial airlines. Airlines like a bright, glossy appearance for their aircraft. UAL's specification calls for no less than 95% reflectivity. The Air Force prefers a low-gloss appearance. Their specification calls for no more than 12% reflectivity, and on special operations aircraft, no more than 5%. The Air Force is interested in minimizing radar and infrared signature. These are not major concerns for commercial airlines.

Corrosion issues are not a big concern, as US carriers usually sell their aircraft before corrosion becomes an interest item. At UAL, the fleet average is 10 years. The Air Force holds onto aircraft much longer. When we took fighter and attack aircraft out of the calculation, we found that the USAF's bomber, tanker, and transport fleet's average age was 29 years. A major player in corrosion prevention is the use of anticorrosion primers.

Total Cost Analysis

Our study used the Environmental Protection Agency (EPA) Total Cost Analysis to examine the cost benefits of using ASF rather than paint. Traditional cost-accounting methods look at the cost of materials and direct labor. Utilities, waste disposal, equipment investment and upkeep, medical costs, etc., are usually lumped together as "overhead."

Using this method at WR-ALC, in the C-141 (LJ) System Program Office, we found that painting is less expensive, by $0.15 per square foot applied. However, spray painting is equipment-intensive. It requires special facilities for painting and depainting. Workers require protective equipment such as Tyvek protective suits, breathing equipment, boots, and gloves; they also require medical testing and monitoring. The air must be filtered and conditioned before it enters the facility. Air emissions must be removed before the exhaust air is released. Liquid wastes must be captured and properly disposed of. When some of these costs are added to the equation, paint becomes more expensive than ASF, by $0.87 per square foot.

We could not capture all of the costs of painting. WR-ALC has a very progressive cost-accounting system. It identifies hazardous waste disposal costs and charges the responsible cost center whenever possible. The costs of air-handling equipment and paint-application equipment are handled as real-property equipment. We were able to get data on the approximate value of this equipment and the cost of upkeep.

However, the system does not consider the administrative costs or the labor costs of physically handling HW. The medical costs of employee monitoring, physicals, and laboratory tests are not broken out. Data on the costs of dealing with health problems caused by the use of hazardous materials was unavailable.

Despite the lack of data, we were able to estimate that, for a C-141, ASF would cost 10% to 15% less than the present paint. It would also eliminate 90% of the total amount of HW produced by the C-141 periodic depot maintenance (PDM) process.

Summary of the ASF Approach

The ASF process has some benefits as well as some technical problems that need to be resolved; however, they do not appear insurmountable.

Benefits

Anticorrosion Efforts

On most Air Force aircraft, an anticorrosive primer will be needed. ASF can be applied over the primer, and its removal should not disturb the primer. In effect, with ASF, one primer coat should last for the remaining life of the aircraft. Experts at the Corrosion Control Center estimate that an undisturbed primer coat could provide protection for over 50 years.

Compatibility with Composites

Unlike chemical or mechanical paint removal, ASF removal will not harm composite structures. This will be an interest item in new aircraft with significant amounts of composite surfaces.

Environmental Effects

Relatively small amounts of HW are needed to remove ASF, compared to paint; i.e., ounces rather than thousands of pounds. Depending on the color schemes chosen, heavy metals may be needed. However, it may be possible to meet operational requirements without using large amounts of heavy metals. The present adhesives are not environmentally hazardous. If heavy metal pigments are not used, the removed polyester and polyurethane films are standard industrial waste, rather than HW.

Cost Savings

Using ASF rather than paint would give a savings of at least $3.7 million for the C-141 fleet. A large amount of HW would not be created—and could not pose a potential problem in the future. Many hundreds of workers would not face potential exposure to health risks.

Drawbacks

There were some problems with the adhesive presently used for this project. It reacted badly with the chromium ion on the electroconversion coating. The adhesive used on the film used by US Air does not react with the chromium. Thus, it would not seem impossible to formulate a usable adhesive. The film has no anticorrosive properties and does allow oxygen and water to pass through it. A possible solution to this would be to use a long-lasting anticorrosive primer such as koroflex or polysulfide. There are some primers that were developed, but not used, because they were too hard to remove. This defect could be an advantage, when used with aircraft film.

Conclusion

ASF is not ready for use on Air Force aircraft today. However, there are many potentially beneficial aspects to this technology. It would appear to warrant further research.

The following short news items (extracted from *Center Views*, a newsletter published by the Air Force Center for Environmental Excellence (AFCEE), Brooks AFB, Texas, DSN 240-4228; Commercial (210) 536-4228) are provided to give our readers an idea of the diversity of the Air Force's involvement in environmental challenges and solutions.

Environmental Team Assists Lithuania

In a show of international solidarity between environmental organizations, the Air Force responded recently to a request for assistance from the Lithuanian government.

The Lithuanians requested help in assessing the extent of pollution and developing solutions for cleaning up the environmental problems at a former Russian air base located just outside the city of Siauliai, Lithuania.

The installation had been an operational base for more than 100 Soviet aircraft and a portion of it was used to perform depot level maintenance on MiG aircraft belonging to Third World countries.

Before leaving, the Russians had done some remediation of contaminated soil, but there is still a lot of environmental work needed before the base can be considered cleaned up.

The Air Force sent a six-member United States Environmental Assistance Team to help. The team, which was divided into three specialized groups, included four persons from Brooks.

The Radiological Survey Team consisted of AFCEE's Lt Col Charles Scott, who served as technical team chief, and Capt James Hicks, from Brook's Occupational and Environmental Health Directorate of Armstrong Laboratory.

Two other people from Brooks, Lt Col Ross Miller of AFCEE's Technology Transfer Division and Jim Morgan of the Mitre Corporation, composed the Petroleum Survey Team.

The Document Search and Compilation Team was made up of Lt Col Jay Carson, US European Command, Stuttgart, Germany; and Leo Vasaitis, US Navy Engineering Field Activity, Mediterranean, Naples, Italy. Carson acted as the group's team chief and escort while in the country.

"Our approach to the problem consisted of a combination of field surveying and analysis as well as study and analysis of existing information," said Scott. "Many of the people we worked with at Siauliai spoke English, which was helpful since all the documents we reviewed were written in Russian and had to be translated for us. Basically, they had to translate Russian to Lithuanian and Lithuanian to English.

"Vasaitis and Carson accepted and reviewed all the documents that the local officials would bring to us, interpreting them and looking for other areas that we may have needed to look at," he continued. "Additionally, they reviewed health records of the local populace and took care of the detailed report of everything we did while we were there."

As part of the radiological investigation, the team also surveyed former radium burial sites, a nuclear weapons staging area, fighter aircraft hangars, and other possibly contaminated sites. "We only found one area that showed contamination and that was the radium burial site," Scott said. "We recommended to the Lithuanians that they install fencing with warning signs around the site as a short-term fix and put a concrete cap over the entire radium burial area for long-term containment."

"Soil sampling data will be evaluated here at Brooks and a preliminary risk analysis will be provided to the Lithuanians for their action," Scott said.

At fuel products areas, the team found mainly hydrocarbon contamination. "We tried to determine the extent of contamination and remediation/biodegradation potential," he said.

Miller added that it was difficult to determine the extent of ground water contamination. Samples taken showed low levels of contamination and the team recommended that Lithuanian investigators continue to improve off-base sample collection and analysis.

The group also advised the Lithuanians to monitor well construction, standardize their sampling and laboratory procedures, and determine the hydraulic relationships between the aquifers to assess long-term remediation requirements.

"The trip was a valuable exchange of information," Scott concluded. "One of the points it drove home was that cleanup of existing environmental problems is an issue everyone is having to face. If we are able to help others in this area, I believe we're making a positive difference in creating cooperation and a better future for a cleaner environment."

Gary DuPriest
AFCEE Public Affairs

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'Try-Before-You-Buy': Program Lets Air Force Test New Products

It would be a great deal for consumers if they could take home a product—a car, washing machine, lawn mower, or whatever—use it for a certain period of time, and buy it only after being sure it was what they wanted.

Well, that is exactly what the Management and Equipment Evaluation Program, or MEEP, does.

This unique "try-before-you-buy" Air Force program allows the service to test, at no cost to the government, state-of-the-art commercial products in the field or shop where the items would normally be used. Manufacturers "lend" their products to the Air Force for an evaluation period that may last anywhere from six months to two years.

Selection of the products is made by representatives of the MEEP management office, Eglin AFB, Florida; Air Force Civil Engineering Support Agency, Tyndall AFB, Florida; and major command MEEP field offices throughout the country.

Representatives from these organizations look for new products at industrial trade shows, in manufacturers' brochures, and in trade magazines. But bases, major commands, and manufacturers or their representatives may also submit candidates for evaluation.

"We're looking for anything that has the potential to enhance day-to-day operations," said Jacob Detweiler, Air Force MEEP chief.

He said that although the program focuses mainly on products related to transportation and civil engineering activities, interest is increasing on items that address environmental issues at the base level. He also noted that MEEP currently has about 30 active projects that are environmentally related.

For example, MEEP is looking at several types of automotive oil filters that promise to be more efficient and have a longer service life. Because of the filters' improved filtration system, oil and filters do not have to be changed as often.

According to a MEEP report, preliminary results indicate that the filters are performing exactly as advertised and could revolutionize the automotive repair industry if they are properly used.

More importantly, reductions in used oil and filters could help cut the waste streams across the nation, not just on Air Force installations.

Products selected for the program are tracked by their respective major commands to ensure that the items are fully used and tested during the evaluation period. The data collected are then used in a post-test analysis to determine if the Air Force should procure the item. All information is shared with other federal agencies.

"Testing products for potential use before spending scarce Air Force dollars helps assure that the item being bought represents the right product for the job," Detweiler pointed out. "If a product is superior to something already in the inventory, then the new item is usually selected to replace the less advantageous item. That way MEEP procedures help cut through bureaucratic red tape in the procurement process."

For details on MEEP, call the program management office at DSN 872-4217, Exts. 229/230/231/233.

Gil Dominguez
Editor, *Center Views*

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Latest in Recycling News

The General Service Agency/Federal Supply Schedule (GSA/FSS) is expanding its offering of recycled products and equipment, including the following:

• Environmentally-friendly paper products have been expanded to include three new paper towels and a new single ply toilet tissue made from 90-100% post-consumer recovered material (PCRM). For more information, contact Terry Pringle, Office Supplies & Paper Products Commodity Center, (212) 264-3547.

• The Federal Tire Program, managed by the Automotive Commodity Center, is doing its part by ordering retreaded tires on schedule. The tire types and sizes available as retreads are shaded in Schedule 26, Part IIA. Using retreads from the GSA schedule allows you to comply with EPA guidelines for federal procurement of retreaded tires (40 CFR 253). This helps the environment in two ways: (1) it reduces the number of tires in landfills, and (2) it takes 75% less oil to manufacture a retreaded tire than a new one.

• "TRACY": Trash collection and Recycling vehicles Available Commercially for You. The GSA/FSS now offers over 90 different models of vehicles from 16 different vendors. Vendors are offering recycling trucks and trailers, liquid waste trucks, trash removal trucks, and container movers. This program is officially found under FSS Schedule 42, Part IV. The names and designated points of contact familiar with their offerings are listed for each vendor along with pricing and ordering information. The schedule was updated and a cumulative edition issued 6 July 1993.

• Remanufactured toner cartridges for laser printers and fax machines are now available. Used cartridges have been disassembled, rebuilt, and quality checked to ensure highest standards of performance are met. Recycling used cartridges is simple: (1) slip empty cartridge and parts into the original shipping box; (2) affix the prepaid UPS address label that is provided; and (3) seal and mail.

To obtain more information and to determine which cartridge is right for you, consult your printer's owner manual or call your GSA representative at (703) 305-3376 or fax your request to (703) 503-5388.

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Government Is Getting "Greener"

The federal government has gone "green" in a big way.

The Government Services Administration (GSA) offers more than 2,100 environmentally sound items in its supply catalog, and hundreds more are available in FSSs.

Over 900 of these items are recycled products which are also listed on the MUFFIN electronic bulletin board and in GSA's Recycled Products Guide. The products include a variety of office paper supplies, such as bond, copier and writing papers, and envelopes. Also available are recycled and cardboard boxes, rubber mats, thermal building insulation, toner cartridges, and retreaded tires.

In the paints and chemicals area, hundreds of GSA's marine and architectural paints and coatings have been reformulated to reduce or eliminate voltile organic compounds, or VOCs, and lead content. Solvent-free industrial cleaners and degreaser alternatives are also offered. GSA's VOC Newsletter contains valuable information on these items. Contact Barbara Peterson at (206) 931-7544 to get on the mailing list.

Also, more than 60 energy efficient household appliances are available in both gas and electric models, including dishwashers, washers, dryers, ranges, and refrigerators/ freezers. And for the third year, GSA's Interagency Fleet Management System (IFMS) is offering vehicles which are alternative fuels or blends, providing a potential to conserve energy resources and improve air quality.

To aid in hazardous material disposal, a new FSS now offers recycling services for solvents, oils, and other liquid materials.

Other new environmentally oriented products include shipping pallets and part benches made from recycled plastic, and floor mats made from recycled tires.

Questions regarding environmental aspects of these products and services should be addressed to the Federal Supply Schedule Environmental, Engineering and Commodity Management Center at (703) 305-7445.

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Environmental Impact Study Requires Public Input

The Environmental Impact Analysis Process (EIAP) for closure bases is detailed and comprehensive. Lt Col Gary P. Baumgartel gives this summary of how his Environmental Planning Division tackles the EIAP:

• A notice of intent to produce an EIS is published in the Federal Register. This is followed by one or more scoping meetings, which are formal hearings attended by the press, political leaders, interest groups, and the general public. At these meetings, the Air Force gives an overview of the proposed project or action and explains the environmental analysis process.

The intent of scoping is to solicit comments from people who are concerned about environmental impacts or the proposed action. Individuals may express their concerns either orally or in writing. The scoping process brings out the sensitive issues or areas of most concern, on which the EIS will focus.

• The Environmental Planning Division begins to gather data in the different environmental areas; for example, air and water quality. The division provides a "snapshot" of the existing environment and how it may be affected by the proposed action/project. Also studied are effects on such areas as archeological and historical sites, wetlands, endangered species, and others. And although not required by regulations on base closures, a socioeconomic impact statement is prepared for the EIS.

Additionally, the Air Force develops a precise description of the proposed action/ project and produces a description of proposed action alternatives, or DOPAA. This is a look at reasonable alternatives that will meet operational needs but may be more environmentally acceptable.

By this point the Air Force has publicly described what it wants to do or prefers to do and has presented reasonable alternatives. The service also studies a "no action" alternative, which points out what the community stands to gain or lose if the proposed action/project is not carried out.

• All data and analyses are packaged into a formal package called the draft EIS. Again, a formal public hearing is conducted, presided over by an administrative judge. During the hearing, the Air Force describes the proposed action/project and its concomitant environmental impacts.

Interested parties attending the hearing may comment on the document either orally or in writing. There is a 45-day period during which concerned individuals, civil leaders, and groups may submit their comments.

• Comments on the draft EIS are addressed and become part of the document. It may be changed if an issue was missed or some aspect was not analyzed properly. Or if something was already covered in the document but a citizen did not understand it completely, the topic is clarified.

All material—comments, questions, replies, and changes—go into the final EIS. The final document is then filed with the Environmental Protection Agency and a notice is placed in the Federal Register. The final EIS is also submitted to the Air Force decision makers for their review to assure that they are aware of all of the environmental impacts that may result from their decisions.

• Decision makers cannot make a final decision on the action/project until thirty days after the final EIS has been filed with the EPA. When a determination is made, the decision makers must explain how they arrived at their conclusions. This information is packaged into a formal administrative document called a Record of Decision, which is published in the Federal Register.

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Halon Reuse Protects the Ozone

Most aircraft, with few exceptions, contain a fire-suppression system that activates in the event of a fire. Typical systems utilize firebottles containing a fire-extinguishing agent called Halon 1301.

San Antonio Air Logistics Center at Kelly AFB, Texas, maintains these firebottles for the C-5 transport and other Air Force aircraft. All firebottles are purged of their contents and tested before undergoing routine depot maintenance at SA-ALC. After maintenance, the items are recharged with Halon 1301.

Previously, the Halon that was purged from the bottles was released into the atmosphere. In 1991, however, SA-ALC stopped this practice because of studies showing that the chemical was contributing to the destruction of the stratospheric ozone layer.

Because of this restriction and the fact that industry is ceasing production of ozone-

depleting chemicals, SA-ALC officials recognized that the center would not be able to support the maintenance of firebottles by the end of the century. With this in mind, the Air Logistics Center conducted feasibility studies to look into recovering and recycling the Halon 1301 from firebottles.

In order to properly recycle Halon, certain contaminants, including particles, water, acid, and nitrogen had to be removed. In accordance with Federal Aviation Administration and Air Force technical order requirements, the recovered and recycled Halon must comply with military specifications.

Although there were many "recycling" machines available, none of these could remove the nitrogen dissolved in the Halon. Nitrogen acts as a pressurizing agent to recharge the bottles.

Late in 1991, SA-ALC wrote a specification for a Halon 1301 recycling machine, requiring the equipment to remove all contaminants from the Halon and leaving the chemical of a grade sufficient to meet MIL-M-12218 specification requirements. The SA-ALC equipment specification required the use of a 5-micron filter to remove particles, a desiccant to remove water, a filter to remove acids, and a distillation process to remove the nitrogen.

Development of the distillation process proved to be the key to an effective recycling machine. The equipment would be required to chill the contaminated Halon down to a temperature of 60 degrees Centigrade. Halon 1301 undergoes a phase change at this temperature, from gas to liquid, making it possible to bleed off the nitrogen which remains in a gaseous phase.

Cost estimates for the recycling machine were in excess of $200,000. An economic analysis revealed a payback period of between two and three years. Currently, Halon 1301 costs $3.50 per pound. Under tax levies established by the Clean Air Act Amendments of 1990, Halon 1301 will cost an additional $26.50 per pound in 1994. By 1997, the taxes on Halon will exceed $40 per pound. Considering the amount of these taxes, it becomes more cost efficient to recycle the Halon.

In addition to the economic gains, SA-ALC will be helping to preserve the environment. Halon 1301 has an ozone depleting potential of 10, making it one of the most harmful chemicals to the ozone.

In January, the recycling equipment was purchased from Pacific Scientific and installed at Kelly AFB's hydrostatic shop. SA-ALC is currently running acceptance tests on the new system to ensure it meets all specifications.

Capt Peter Poon
2nd Lt Gerald R. Gendron Jr.
San Antonio Air Logistics Center

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Air Force Searches for Halon Replacement

During the past four years, the Air Force Civil Engineering Support Agency, Tyndall AFB, Florida, has led the effort to find a replacement agent for Halon. As a result of AFCESA's work, a number of candidate replacements have been identified.

The agency is currently doing validation work on a compound that extinguishes fires almost as effectively as Halon 1211, which is used in fire extinguishers as a streaming agent. The candidate compound has zero ozone depleting characteristics and zero toxicity.

The validation work for the compound is now underway and will verify its ability to serve as the new clean firefighting agent for the Air Force.

The service's approach to the Halon problem is threefold: reduce the amount of Halon used; recycle and conserve the agent as much as possible; and find a replacement for it.

Both Halon 1301 and Halon 1211 are used extensively in Air Force firefighting and fire protection.

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Not Fooling Mother Nature: Air Force Tests Natural Attenuation

In August the Environmental Protection Agency began collecting data with AFCEE at the site of a hydrocarbon contamination plume on Hill AFB, Utah. The purpose of the data gathering is to determine how fast nature is cleaning up the mess people have created. The process is called natural attenuation.

AFCEE believes the data will demonstrate that naturally occurring organisms can eat enough of the fuel hydrocarbons to stop the groundwater plume from moving and eventually render it harmless.

The EPA's Kerr Laboratory, located in Ada, Oklahoma, has provided a field lab, Geoprobe, and drilling rig to collect water samples at the Hill site. The site investigation will also give the Armstrong Laboratory Environmental Quality Directorate at Tyndall AFB, Florida, a chance to test out its cone penetrometer, a new piece of technology that extracts soil and groundwater samples and gathers information on hydrogeology and contamination.

The collected data will then be used in a computer model that simulates the plume's progress, allowing researchers to predict how fast and how far the contamination might travel before natural attenuation stops it. The computer model will be run jointly by the EPA and an AFCEE contractor. The contractor will also prepare a work plan and final report for regulatory review.

Lt Col Ross Miller, chief of AFCEE's Technology Transfer Division, explains that previous studies indicate that fuel contaminants known collectively as BTEX, for benzene, toluene, ethyl benzene and xylene, do not move very far.

"Let's say that the dissolved phase (contamination) is moving several hundred feet from the oily phase (source) and stopping," he says. "It's stopping because nature has found a way to eat that stuff. Those microbes are eating the dissolved fuel much faster than groundwater can move it, so its essentially stopped. It's reached equilibrium, potentially."

The movement of contamination at the Hill AFB site will be monitored using a series of "sentry" wells installed some distance in front of the plume and also along its centerline. Periodic samples taken from the wells will help researchers "to determine exactly how fast the contamination is going away naturally and to ensure that our predictions are not wrong, and that we're not threatening anybody by allowing the plume to naturally attenuate," says Miller.

The entire process, from collecting data to monitoring wells and analyzing samples, will take from one to two years.

Natural attenuation has the potential of saving the Air Force millions of dollars in remediation costs, according to Miller. If Mother Nature can remove fuel contamination from groundwater, the government does not have to invest funds in highly expensive processes. such as pump-and-treat. And while natural attenuation takes decades to complete, pump-and-treat is not much faster, he notes.

"We believe that we can complete characterization of a site, run the models, and probably do the first-round of long-term monitoring in our sentry wells for a little less than $200,000 at a typical site," Miller states.

He adds that the reason why natural attenuation has not been tried in the past is because its proponents did not adequately present the process.

"The data has not been collected nor have the models been run nor has there been Air Force site investigations to really quantify the natural attenuation process," Miller explains. "We want to change that and make sure the right data are collected up front and evaluated so that natural attenuation is set up fairly against all the other alternatives for cleaning up a site.

"We think that through our nationwide demonstration we'll bring enough visibility to the process, and when we do evaluate it and show that the plum is not moving or is receding and not threatening anyone, we'll have a much higher chance of getting regulatory approval to use natural attenuation as a final fix," Miller says.

Gil Dominguez

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Preparation Best Shelter Against Clean Water Act 'Storm'

Due to provisions in the Clean Water Act, now every time it rains the Air Force may be liable for fines and penalties.

The Clean Water Act requires that all waters of the United States be "fishable and swimmable." To achieve this standard, Section 402(p) of the Clean Water Act requires facilities with industrial storm water discharges to obtain a permit.

To comply, bases had to apply for either an individual or general permit by submitting an individual, general, or group application. In July of last year, 133 Air Force facilities

submitted a group application to obtain individual permits for industrial storm water discharges. The remaining bases submitted individual applications or filed a Notice of Intent (NOI) for a general permit.

As of 29 June, 93 facilities remain in the group application. The remaining 40 either do not need a permit or have obtained individual or group permits.

The individual permit conforms with the standard National Pollutant Discharge Elimination System (NPDES) format and requires that the installation apply directly to the authorized state or EPA. The individual permit is customized by the NPDES permit writer based on the permit submitted by the facility.

The general permit published in the regulations requires facilities to submit an NOI. In the NOI the facility certifies that it will comply with the published rules of the general permit. The authorized state or EPA issues the facility a permit number based on the submission of the NOI.

EPA originally received 1,954 group applications covering 105,000 facilities. Approximately 700 group applications covering 40,000 facilities remain in the process. The EPA divided the 4,000 facilities into 31 industrial sectors based on similar industrial activity. EPA plans to incorporate all 31 sectors into a single, multi-sector general permit utilizing pollution prevention as the basic control mechanism. Permit guidance will be issued on July or August, and individual permits will be issued by the 1 October court-ordered deadline.

Storm water is a self-implementing, pollution prevention enforceable program. Facilities with permits must write a pollution-prevention plan detailing identification, monitoring, and elimination of industrial storm water discharges. The goal of the EPA is that facilities should not use hazardous chemicals.

When hazardous chemicals are used, only the minimum amount should be properly used and stored to prevent discharges to any media (land, air, or water). This has been the Air Force goal, but now the EPA has enforcement authority to make sure we eliminate discharges.

Storm water regulations are self-implementing, but failure to comply with your own pollution prevention plan can result in fines of up to $250,000 a day and 15 years in prison per violation. The waiver of sovereign immunity for the Clean Water Act is working in Congress now and will probably be effective this year. EPA wants pollution prevention plans to be the carrot to eliminate industrial storm water discharges, but is ready with the enforcement stick should these plans fail.

Facilities should check the status of their storm water permit application with the authorized state or EPA Region. Facilities should be conducting cross connection surveys to identify unpermitted industrial discharges to the storm water system; prepare pollution prevention plans now to determine the extent of requirements; and start programming and budget actions.

Implementing pollution prevention plans will shelter facilities from the storm of fines and penalties that could result from failure to control industrial storm water discharges.

Contact the author at AFCEE/CCR-D (214) 767-4671 for more information on storm water permitting or the status of the Air Force group application. For other storm water questions, call the EPA Storm Water Hotline at (703) 821-4823. Another valuable source is AFCEE PRO-ACT at (800) 233-4356 or DSN 240-4214.

Johnny Combs, P.E.
Regional Compliance
Office-Dallas

* * * * *

Environmentally Acceptable Cleaner Available

An environmentally acceptable cleaner that contains no VOCs has been approved as a P-D-680, Type III solvent alternative. This cleaner, trade name "Hurri-Safe," does not contain solvents and may be treated by most industrial wastewater facilities without additional equipment or specialized processes. Tests of this cleaner by the Army, Navy, and Coast Guard have shown that it can remove light oils and production fluids from steel and aluminum parts. The cleaner can be used as either a direct solvent replacement in "write-on, wipe-off" applications or as a constituent of an ultrasonic cleaning bath. The cleaner is available under NSN numbers NSN-6850-01-369-2474 (5 gallons) or NSN-6850-01-369-2475 (55 gallons).

For more information concerning environmentally acceptable cleaners, contact Mr Jack Hurd at HQ, Army Materiel Command, (703) 274-0815/0816.

Pollution Prevention Conference Planned

It is not too early to start making plans to attend the 1994 Air Force Worldwide Pollution Prevention Conference and Exhibition scheduled from 30 August to 1 September at the San Antonio Convention Center.

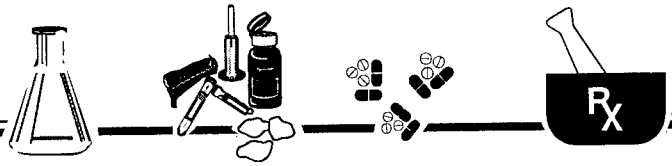
AFCEE's Pollution Prevention Division (ESP) of the Environmental Services Directorate will be the host of the third-annual event. The meeting will be similar to last year's conference format—except that the 1994 meeting will be bigger and better.

The conference's focus will again be on base-level applications and new technologies. The target audience consists of civil engineering, logistics, maintenance, acquisition and supply, and bioenvironmental engineering communities. Officials said that anyone who generates waste, whether hazardous or nonhazardous, will benefit from the conference's numerous seminars and exhibits.

The 1993 conference attracted more than 850 people from 80 Air Force bases and 15 countries. Military, government, and private-industry representatives attended over 20 different breakout sessions on pollution-prevention applications and technologies, and training on the Toxic Release Inventory (TRI).

Others who would like to be placed on the mailing list for the 1994 conference should E-Mail or fax their name, position/title, organization, official address, telephone and fax number to Vicki Preacher (fax DSN 240-4254). Or mail the information to AFCEE/ESP, c/o 1994 AFWPPC, 8106 Chennault Road, Brooks AFB, Texas 78235-5318.

Managing Hazardous Materials: A Pharmacy Concept



Elizabeth Davis

In the 7 January 1993 Air Force Pollution Prevention Program - Action Memorandum, General Merrill A. McPeak, Air Force Chief of Staff, and Donald B. Rice, Secretary of the Air Force, committed the Air Force to environmental leadership:

> Our goal is to prevent future pollution by reducing use of hazardous materials and releases of pollutants into the environment to as near zero as feasible. To achieve this, we must quickly move away from dependence on hazardous materials . . . to succeed we must mobilize our whole team and find ways to move faster.

A very successful mobilization of the "whole team" is occurring in response to the Chief's direction—the Hazardous Material Pharmacy.

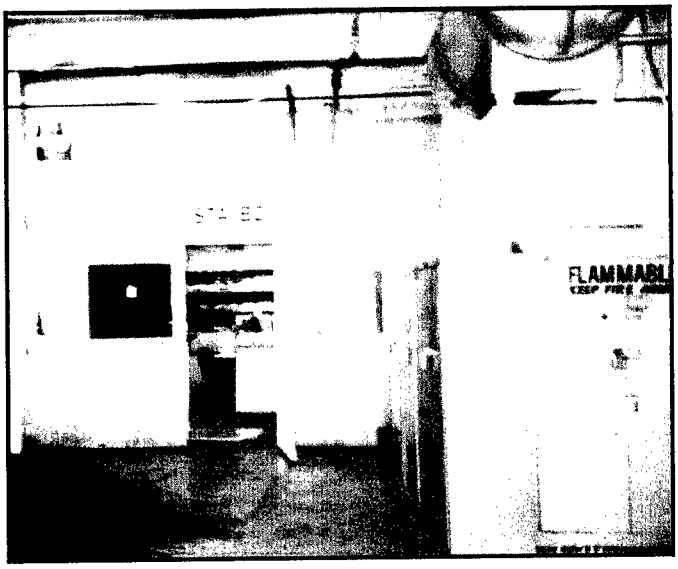
Analogous to a medical pharmacy dispensing only the amount needed, Headquarters Air Force Center for Environmental Excellence (HQ AFCEE) uses the term "Pharmacy" to describe the concept of hazardous material management currently in operation at several Air Force bases. The Pharmacy establishes a single point of control and accountability over the requisitioning, receipt, and issuing of material commonly used in aircraft maintenance as well as everyday base operations. The concept uses intense inventory control procedures for substances which contain hazardous materials to provide data for regulatory compliance and to reduce the amount issued to only what is needed, thus reducing the amount entering the hazardous waste stream. The inventory control procedures used for hazardous materials are not dissimilar to those currently in place for precious metals, tools, explosives, and ammunition.

Currently, a base may be supported by 6 to 10 supply sources, any or all of which may bring hazardous material onto the base through normal procurement channels. Though this method of obtaining materials is intended to provide flexibility and responsiveness in supporting the many diverse missions on a single base, it actually translates into lack of control and accountability of hazardous material. We no longer have that luxury.

Air Force Instruction 32-7080, *Pollution Prevention* (draft), directs installations to develop procedures which centrally control hazardous material purchase. and use. The Pharmacy is a commander's program which can provide directed central control. All MAJCOMs are now involved to varying degrees, including USAFE and PACAF. The Pharmacy is a concept which is rapidly becoming the preferred method of centralized hazardous material control.

Pharmacy Goals

There are two primary goals of the Pharmacy. First, the hazardous material Pharmacy is to be the single point for accountability and control of hazardous material for an installation commander. Second, the Pharmacy must provide the highest level of customer support and be the single source of hazardous material requisitions and distribution when the material is received. Failure in customer service will ultimately mean a return to multiple sources of hazardous material and reduced accountability.



Forward Distribution Point of Hazardous Material Pharmacy.

The Pharmacy does this by issuing material to requesting base organizations, having first established a requirement for the material and having met all regulatory, training, health, safety, and environmental protection precautions required by law for use of the hazardous material. The amount of material issued must match the current need—no more, no less. The Pharmacy then maintains full tracking of each material receipt, storage, issue, and transfer, including the related environmental aspects and the chemical components of the substance.

Hazardous Materials

Hazardous materials are any substances, which because of the quantity, concentration, physical, chemical, or infectious characteristics, may pose a substantial hazard to human health or the environment when released or spilled. DoD Directive 4210.15, *Hazardous Material Pollution Prevention,* defines hazardous material as "anything that due to its chemical, physical, or biological nature causes safety, public health, or environmental concerns that result in an elevated level of effort to manage it." The Directive goes on to say "what matters is not whether something fits precisely in a definition or whose definition it is, but whether it may be better managed to mitigate the problems it causes and improve the quality of defense." Hazardous materials commonly used by the USAF include solvents, lubricants, cleaners, paints, glues, and adhesives. Generally speaking, in the past, bases were most concerned with materials which could have a negative impact on worker health and safety, but now the concern is much broader.

On 3 August 1993, President Clinton signed Executive Order 12856 which has significant impact on the number of chemicals which require tracking. This Executive Order mandates that *all federal facilities*, including the Department of Defense, comply

with the Emergency Planning and Community Right-to-Know Act (EPCRA) and the 1990 Pollution Prevention Act. Section 313 of the EPCRA directs annual submission of a Toxic Release Inventory. There are currently close to 400 chemicals listed under Section 313 of EPCRA. Sources within the United States Environmental Protection Agency (EPA) predict an increase to 600 in the near future. Clearly the reasons for instituting close controls on hazardous materials are growing more numerous, not less.

Hazardous Material Management Benefits

Management of hazardous materials can be improved by tightening up the management controls already in place. Hazardous materials have inherent problems, such as shelf-life expiration dates, environmental and worker exposure, safe and secure inventory space, personal protection equipment, disposal and liability costs, and environmental reporting requirements, which tighter controls can often mitigate.

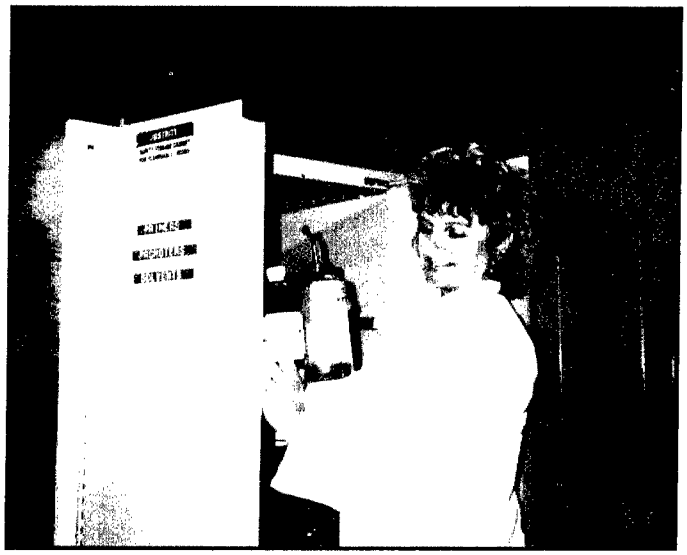
The benefits are twofold. First, there have been a number of pieces of legislation enacted, amendments passed, and executive orders signed, which are designed to protect human health and the environment. All of these mandates require documentation for proof of compliance—documentation that requires extensive data to complete. Improved management controls can readily provide the facts and figures needed to document compliance. The single most common reason given for implementing a Pharmacy is to provide EPA or Occupational Safety and Health Administration (OSHA) inspectors with information. The Department of Defense supply system is often cited as a source for on-base hazardous material information, but it simply was never designed to provide that information. The supply system fills requests for material and delivers it to a customer. Which customer or shop uses the material, or how it is maintained or disposed of by the customer, is not the responsibility of the supply system. Under this concept, it becomes the responsibility of the Pharmacy. As material is received by the Pharmacy, the transaction will be entered into a system designed to track the material while it is on the installation. In some cases, the material will be issued to a shop or cost center, or it may be issued directly to the individual.

Secondly, Air Force bases using an intensified inventory control system for hazardous materials have reaped cost savings in both the procurement of material and reduced hazardous waste disposal. By reducing the amount of material purchased to only the amount used, significant cost savings have been achieved. Bases have found three to six years' worth of hazardous materials in stock. The shelf life of some of this material may expire before it can be consumed. The resulting impact on the hazardous waste stream is very severe. One major command estimates that 11% of its hazardous waste is actually unused hazardous materials and that 60% of it could have been reused, which would amount to an annual cost savings to each installation of up to $70,000 in disposal costs. One of the Air Logistics Centers dropped the cost of hazardous material procurement from $14 million to $4 million within two years by establishing a single point of control and authorization.

Three Pharmacy Elements

There are three Pharmacy elements. The first is a single point of authorization and requisition/request. Each request for a substance which contains hazardous material must be reviewed by a team of functional experts. The review will result in an approval or disapproval of the material request. The team consists of bioenvironmental engineering, environmental management, and logistics. This review is an integral part of a successful Pharmacy. The review and subsequent decision by this team of experts provides for the assurance that materials used on the installation are the most environmentally benign, technically acceptable substances used in the smallest quantities. The review nourishes pollution prevention opportunities by giving them a place to grow and thrive. In accordance with DoD Directive 4210.15, "emphasis must be on less use of hazardous materials, in processes and products, as distinguished from end-of-pipe management of hazardous waste."

The second is distributing, dispensing, and collecting hazardous materials. Distributing material only in quantities needed for immediate use has a major benefit for the user. The responsibility for the whereabouts and condition of the hazardous material belongs to the Pharmacy. Shelf-life expiration, compatible storage, documentation, training certifications, and inspections become the concern of the Pharmacy, thus relieving the user of a troublesome burden. Unused materials may be returned or collected for reuse, thereby reducing the hazardous waste stream as well. Dispensing, or the



Distributing Hazardous Materials in the Pharmacy at Hill AFB.

Interior of Hazardous Material Pharmacy Storage at Hill AFB.

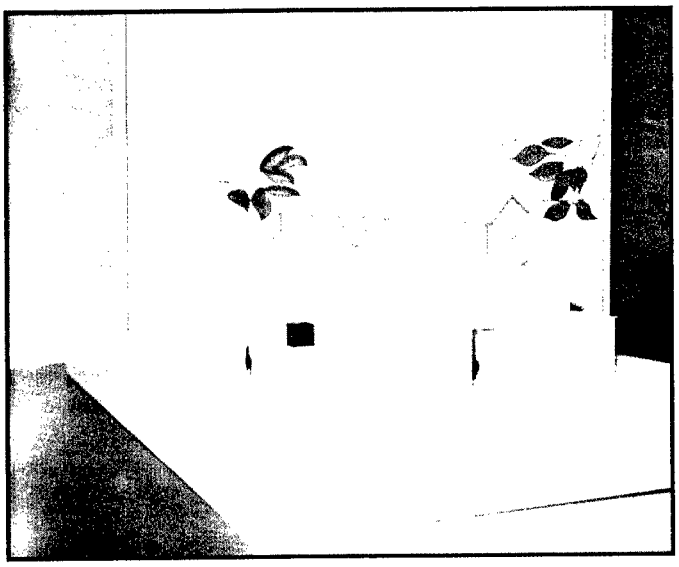
actual pouring of substances from one container into a smaller container, may or may not be a good idea. Experience has shown this to be costly in terms of facility modification for venting and spill capture equipment, so usage volume becomes important. Purchasing material in containers sized for the users' requirements is generally a more economical option.

The third element is the tracking system which connects the review/authorization and the distribution/collection process. Ideally, the tracking system should provide an authorized user code; a record of all inventory transactions; access to the chemical and physical properties of the inventory; tracking of containers; Material Safety Data Sheet (MSDS) files; and, ultimately, the disposal or complete consumption data. The information can be used to analyze usage patterns, establish ordering requirements, provide input data for regulatory reports, and even plan emergency responses by the fire department and disaster preparedness offices.

Implementation Steps

The hazardous material Pharmacy will cross the boundaries of a wide variety of the organizations at a base, such as Supply, Maintenance, Civil Engineering, flight squadrons, Bioenvironmental Engineering, and Environmental Management. The Pharmacy will impact the operations of all the organizations and will require the active involvement of many of them to achieve successful implementation. The cross-functional impact of this program requires total commitment and support from a wing commander that directs the activities of all potential program participants. Implementation of a Pharmacy is a base-wide effort and is described in eight broad steps:

(1) Establish an Implementation Team under the auspices of the Environmental Protection Committee (EPC). There should be wide representation from all areas of the base. One common element of successful Pharmacy operations is the cross-matrix of a full complement of base organizations.



Mock-up of Hazardous Material Facility.

(2) Conduct a baseline survey of all hazardous material on base. It is necessary to know the location of the material, the users, quantity of material required, and avenues of entry.

(3) Develop a concept of operations. For instance, the concept should describe the goal or charter of the Pharmacy, the materials it will supply, its method of tracking, the level of customer support, and whether it will involve single or multiple distribution sites.

(4) Determine resource requirements. The Pharmacy may need a facility. Manning, equipment, and budget, as well as other base resources, must also be made available.

(5) Develop an implementation plan. For successful implementation, it is recommended the Pharmacy be phased in over a period of one to two years. The implementation plan may include, but is not limited to, customer training,

Answering a Few Questions

Is there only one tracking system used by USAF?

No. Hazardous material tracking systems have been developed by a number of private and public entities. Some are designed for mini-computers and others work on personal computers. Eighty-four non-Air Force Materiel Command (AFMC) bases will receive the Integrated Hazardous Material Management System, a PC and server-based product developed by Modern Technologies Corporation. AFMC bases have either developed their own (primarily the depots), or they will be receiving the Depot Maintenance Hazardous Material Management System, sponsored by the Joint Logistics Systems Center.

Does all the hazardous material have to be located in one place?

No. All the material does not have to be centrally located. The Air Logistics Centers are operating with a varying number of distribution points. Currently, Hill AFB, Utah, is using over 60, and Kelly AFB, Texas, has approximately 20. In contrast, Dover AFB, Delaware, is adequately supplying the customers using only two points.

I know the term "Pharmacy" comes from the act of dispensing or distributing hazardous material to the user in the amount needed. What is the difference?

Dispensing is the process of opening an original container and pouring a measured amount into a container which will better suit the customer's requirement. Distribution occurs when a box or other secondary container is opened, which houses the product in its primary container. The primary container, unopened, is provided to the customer. For example, a single aerosol can is distributed versus the case of 12 cans.

Will all organizations be required to obtain their hazardous material from the Pharmacy?

The Pharmacy concept of operations, developed with regard to all base organizations by the EPC, will define which organizations will be served by the Pharmacy. Careful consideration should be given to current and pending environmental mandates which may impact more organizations than were planned for originally. As it stands, commanders are responsible for the entire base — "fence to fence."

Open Issues

A number of issues remain open or are in the process of being resolved. Acknowledging that commanders may be held environmentally responsible for the entire installation— "fence to fence," this responsibility engenders several challenges. What is the best way to incorporate on-base contractors or tenant organizations? Should deployments be addressed? Should standard operation of a Pharmacy include waste accumulation? Is there a best manning matrix? How may Civil Engineering most smoothly be incorporated? As these issues are resolved, guidance will be made available.

marketing, development of memorandum of understanding documents between the Pharmacy and the customer, and the organization phase-in milestone chart.

(6) Begin implementation. Once the memorandum of understanding is signed, the material lists are agreed upon, the material (excess to the agreed amount) is collected from the shop area, a procedure for requisition review and authorization is configured, and all other requirements (manning, facility, budget) are workable, the next step is to start operating.

(7) Receive and act on customer feedback. One of the goals of the Pharmacy is customer support. Meet this goal by providing an avenue for customer feedback and then act on it.

(8) Promote your success. The Pharmacy is a concept which has evolved in response to the many regulatory and statutory mandates which have been applied to the bases. As the legislation continues to grow and change, so does the concept of the Pharmacy. Your success is invaluable to others in the Air Force.

Elizabeth Davis is Logistics Management Specialist, Air Force Center for Environmental Excellence, Pollution Prevention Directorate (AFCEE/EP), Brooks AFB, Texas.

Recipes for a Healthy Environment

Have you ever thought about how many chemicals you use every day? Disinfectants, cleaners, and air fresheners all contain chemicals that are potentially damaging to your health and the environment. You can make a number of simple substitutions using natural ingredients that work equally well or, in some cases, better. Next time you're cleaning, try some of these.

Spot Remover

Butter, coffee, gravy, and chocolate stains may be removed by scraping off or sponging up as much of the spot as possible and then dabbing with a cloth dampened in a mixture of 1 teaspoon white vinegar and 1 quart cold water. Or--apply a solution made of equal parts ammonia and water. (The residual ammonia stain can be removed with salt and water.) To remove grease spots, try one of these: apply a paste of cornstarch and water; cover with baking soda or cornmeal, let dry, and brush off; or scrub the spot with toothpaste. For spots on rugs, sprinkle on dry cornstarch and vacuum up.

Furniture Polish

Use olive oil, lemon oil, beeswax, or a mixture of beeswax and olive oil. A combination of 2 teaspoons lemon oil and 1 pint mineral, vegetable, or olive oil in a spray bottle also works.

Metal Polish

To polish silver, cover the bottom of an aluminum or enameled pan with aluminum foil. Add silver to be cleaned. Fill with enough water to cover the silver. Add 1 teaspoon baking soda and 1 teaspoon salt. Boil for 3 minutes. Remove the silver, wash in soapy water, and polish dry. *Do not* use this method for silver jewelry or flatware with hollow handles.

For brass, scrub with worcestershire sauce or toothpaste; pour on tomato ketchup, let sit, and remove when dry; or clean with water in which onions have been boiled. For copper, pour white vinegar and salt over copper and rub. To polish either brass or copper, use a lemon juice and salt paste.

Glass Cleaner

Mix 3 tablespoons ammonia, 1 tablespoon white vinegar, and 3/4 cup water and pour into a spray bottle. Other recipes that work equally well are (1) 2 tablespoons vinegar in 1 quart water, and (2) 1 quart water combined with 1/2 cup vinegar and 1 to 2 tablespoons lemon juice or rubbing alcohol.

Oven Cleaner

Oven cleaners usually contain lye, which is extremely toxic. A good alternative to commercial oven cleaners is a paste of water and baking soda which is applied on the spots that need cleaning and then scrubbed with steel wool. (Be careful not to get any of the mixture on the elements.) You can also sprinkle salt on spills while they are warm and then scrub.

Drain Cleaner

Prevent drain clogs by covering drains with screens to keep out grease, hair, and food scraps. If blockage does occur, pour 1 cup each baking soda, salt, and white vinegar down the drain. Wait 15 minutes and then flush with boiling water. If the clog is especially tough, use a plumber's snake or plunger.

Alternately, toss a handful of baking soda and 1/2 cup vinegar down the drain and then cover tightly for 1 minute. Rinse with hot water.

Toilet Bowl Cleaner

Pour 1/2 cup chlorine bleach in the bowl. Let stand for 30 minutes and scrub clean. Or scrub with a solution of 1/2 cup borax in 1 gallon water.

Disinfectant/Germicide

Soapy water is one of the simplest and best disinfectants. Borax and sodium carbonate (washing soda) are also effective.

Air Freshener Deodorizer

Air fresheners do not really freshen air. According to the Earth Works Group, they deaden your nasal passages or coat them with oil so you can no longer smell the offensive odor. Instead, try vinegar or lemon juice in a spray bottle, or set small dishes of either of these liquids or baking soda in various locations around your house. A cotton ball saturated with pure vanilla will overpower foul smells in your car or refrigerator. Grinding lemons in your garbage disposal will leave it with a fresher smell.

All these substitutions are simply made with readily available natural ingredients. Don't feel overwhelmed trying suddenly to change all the cleaners you have always used. Implement a few at a time. Remember, each substitution goes a long way toward creating a chemical-free house, a safer environment, and a healthier family.

Global Environmental Outreach, Feb 1994

The Tidewater Interagency Pollution Prevention Program

Tim Blevins

"As a user of the Chesapeake's many resources, the Defense Department has a shared responsibility to restore and protect this national treasure."

Secretary of Defense Dick Cheney, Earth Day 1990

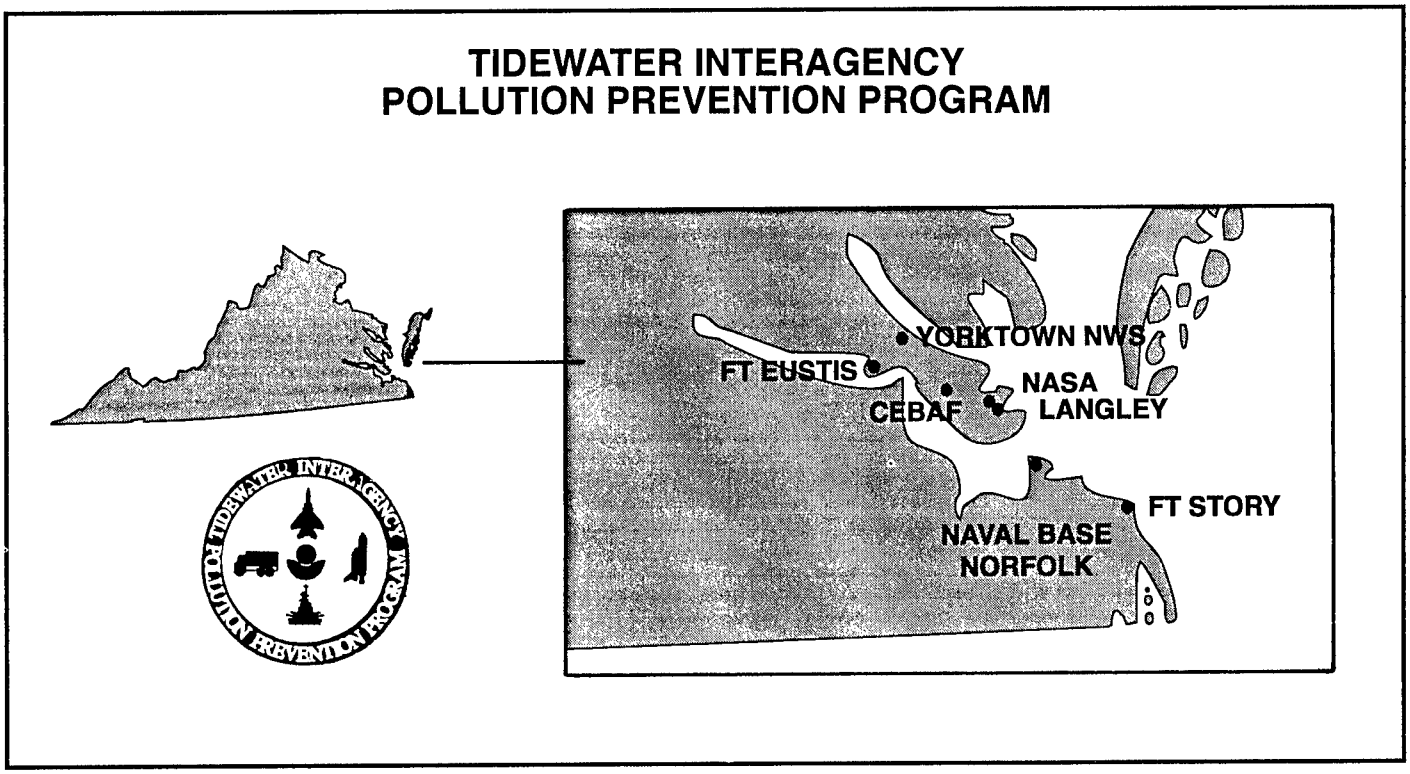
The Tidewater Interagency Pollution Prevention Program (TIPPP) is a cooperative effort between the US Environmental Protection Agency (EPA), the Department of Defense (DOD), and the National Aeronautics and Space Administration (NASA) to integrate pollution prevention into the daily activities of federal installations in the Tidewater, Virginia, area. Headquarters Air Combat Command, Langley Air Force Base, Virginia, is the DOD lead agency for TIPPP. Participants in TIPPP include Langley, Fort Eustis, Fort Story, Naval Base Norfolk, NASA Langley Research Center, Yorktown Naval Weapons Station, and the Department of Energy's (DOE) Continuous Electron Beam Accelerator Facility (CEBAF). Additionally, the Commonwealth of Virginia's Department of Environmental Quality and EPA's Offices of Federal Facilities and Enforcement, Risk Reduction Engineering Laboratory, and Region III Headquarters support the efforts of TIPPP agencies for this innovative multimedia pollution prevention program.

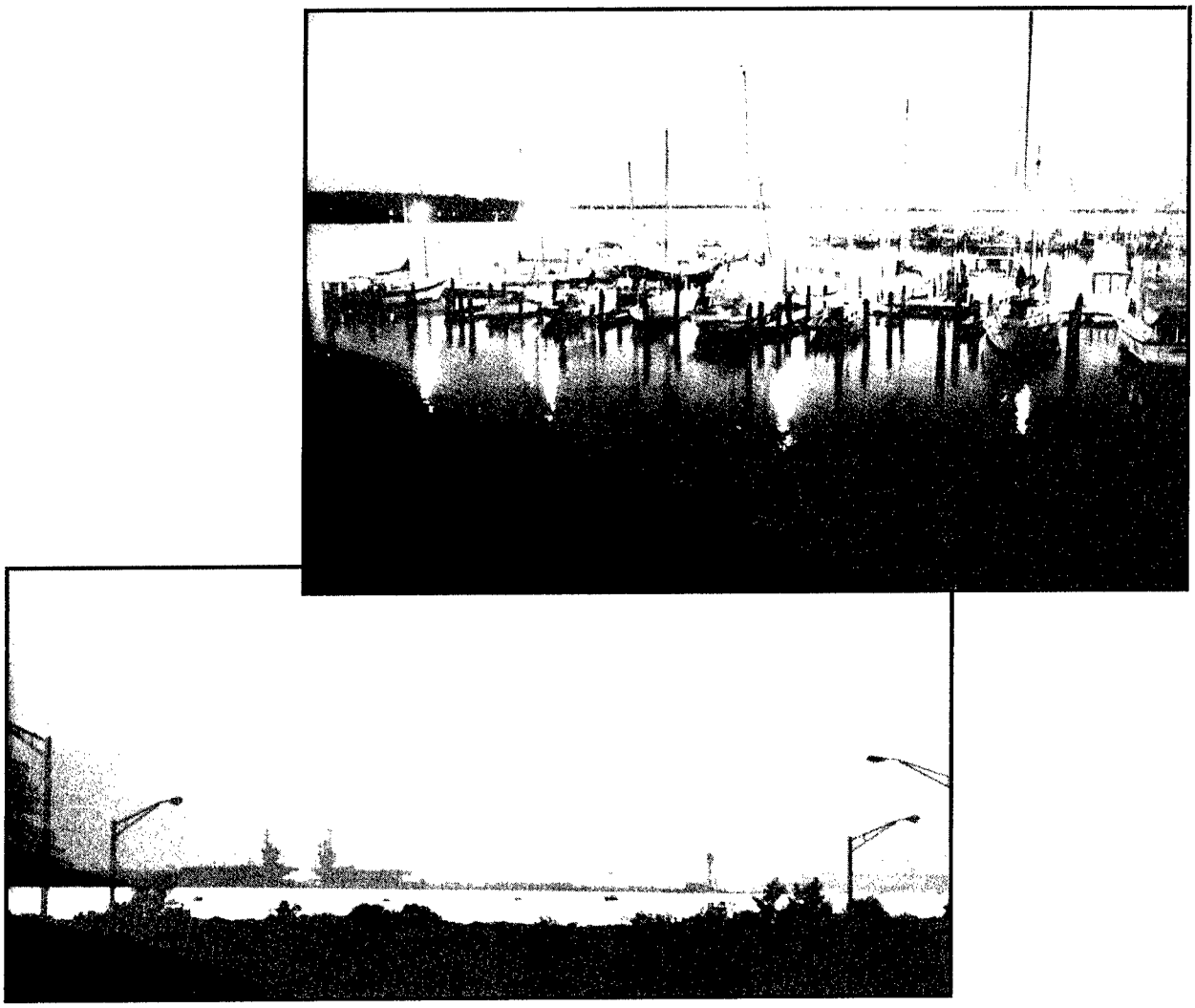
TIPPP's Mission

TIPPP was developed to provide a model for incorporating various pollution prevention concepts on a community-wide basis. By using a well-defined community, such as the federal facilities in the Tidewater area, EPA and TIPPP participants can demonstrate measurable progress and the benefits of pollution prevention practices that might apply to other community partnership programs.

TIPPP Membership

Langley Air Force Base is home to Headquarters Air Combat Command and the 1st Fighter Wing with its associated maintenance and support squadrons. Fort Eustis, along with Fort Story, a subinstallation located some 50 miles southeast, serves as the Army's Transportation Center, providing operations and maintenance training and skills qualification for Army aerial, ocean-going, and land-based transportation assets. Naval Base Norfolk, home of over 200 tenant commands and more than 100 ships, is the largest naval base in the US Navy. NASA Langley Research Center conducts aerospace research with large-scale physics and chemistry programs which use over 6,000 different chemicals. Yorktown Naval Weapons Station is the major naval ordnance maintenance, storage, and outloading facility on the East Coast, servicing ships home ported in Norfolk and other fleet components worldwide. The Department of Energy's CEBAF is the largest superconducting radio-frequency technology installation in the world. CEBAF is also home to the world's largest helium refrigerant plant, which maintains an





average operating temperature of –456 degrees Fahrenheit. Together these facilities cover in excess of 30,000 acres and represent some 250,000 military and federal civilian personnel in the Greater Tidewater Area of eastern Virginia.

Background

Congress declared in the Pollution Prevention Act (PPA) of 1990 that it is national policy to prevent or reduce pollution at the source wherever possible. The PPA further requires EPA to advance source reduction practices at other federal agencies and to identify opportunities to use federal procurement to encourage source reduction. DOD has issued a Pollution Prevention Directive which emphasizes the primary objective of utilizing pollution prevention practices at all levels within DOD. Concurrently, other agencies within TIPPP have issued policy guidance that establishes pollution prevention as a key element of their environmental programs. NASA Management Instruction (NMI) 8800.13B, *Prevention Abatement and Control of Environmental Pollution,* establishes pollution prevention as its policy.

Using Earth Day 1990 activities as a backdrop, EPA Administrator Bill Reilly and Secretary of Defense Dick Cheney signed a Cooperative Agreement to promote environmental compliance of military facilities in the Chesapeake Bay watershed. The agreement pledged the two agencies to work together to clean up and protect the Chesapeake through improved pollution prevention practices, better training of personnel, regular inspections, and policies that ensure no net loss of wetlands.

Of particular note was the DOD and EPA agreement to select a model community within the Chesapeake Bay drainage area to demonstrate how pollution prevention techniques can be combined into an integrated pollution prevention plan. This "model community" would put into motion the pollution prevention ideas embodied in the agreement and help restore the Chesapeake Bay ecosystem.

The TIPPP is an outgrowth of this agreement. Factors that contributed to the development of the TIPPP demonstration effort included:

- Environmental trends.
- Multimedia pollution prevention as an environmental alternative.
- Environmental quality in the Chesapeake Bay.
- The impact of TIPPP installations on the Chesapeake Bay.

TIPPP was initially designed by EPA's Pollution Prevention Office (PPO), DOD's Office of the Deputy Assistant Secretary (Environment), and the Army, Navy, and Air Force. NASA later joined with the addition of the Langley Research Center. The Tidewater area is an especially good place for such a program since the participating installations are within a few miles of each other and are in very close proximity to the Chesapeake Bay. Since its inception, TIPPP has grown to include Yorktown Naval Weapons Station and CEBAF.

Environmental Challenges of TIPPP Installations in the Chesapeake Bay Area

The Chesapeake Bay shoreline covers some 3,600 miles and extends 200 miles inland from where it meets the Atlantic Ocean. DOD has more than 50 installations on about 350,000 acres throughout the Chesapeake watershed. Some major environmental problems are:

- The Chesapeake Bay ecosystem has undergone a drastic and persistent decline in environmental quality.
- There are high levels of nutrient and suspended sediment in Bay and tributary waters, toxic contamination, and loss of vital natural resources such as wetlands, submerged aquatic vegetation, and riparian forests.
- The resulting impact on wildlife and fisheries has been stark. It is estimated that commercial fish landings, depending on the species, have declined 50% to 100% from 1960 levels.
- Waterfowl populations are only at a fraction of their historic levels.

While the exact cause of the Bay's environmental problems are unclear, it is evident that increased urbanization and industrialization of the watershed and changing agricultural practices have hastened its decline.

DOD and NASA installations can significantly impact the Chesapeake Bay ecosystem due to the localized concentration of industrial and residential activity at each installation and their close proximity to the Chesapeake Bay. For example, water used for industrial and domestic purposes, as well as storm water runoff from the installations, ultimately discharges to the Bay, either directly or indirectly through sewage treatment plants or tributaries.

In performing its mission, each TIPPP installation conducts a variety of industrial, community support, and land management activities. The level of industrial activity taking place at Naval Base Norfolk alone is comparable to that of a medium-sized city. Taken as a whole, the TIPPP installations use a substantial amount of resources (energy, water, raw materials) to operate and generate industrial waste, both hazardous and nonhazardous. A large number of personnel and their dependents reside at the installations. These residential areas require significant resources and generate significant amounts of municipal solid waste.

In addition to these quantifiable impacts, the maintenance and growth of the installations themselves may impact the Chesapeake Bay. The TIPPP installations are home to unique indigenous animals and plant communities. The installations cover substantial areas which encompass varied natural resources including environmental sensitive wetlands, stream corridors, and other important plant and wildlife habitat areas. The bald eagle is one of the endangered species living within the boundaries of Chesapeake's TIPPP installations. Land management practices, such as nutrient and pesticide application, storm water management, wetland and stream bank alterations, and forestry practices at the installations, can have a direct impact on local plant communities, fish, and wildlife.

The impacts of any given installation, as a whole, on the bay are unknown at this time. One purpose of the TIPPP is to identify and study such impacts. Once identified, the TIPPP is designed to encourage use of pollution prevention techniques as a means of eliminating or reducing the adverse environmental impacts associated with the operation of these installations.

Organization and Staffing

The Air Force has been designated as the lead DOD agency for the model community. HQ ACC is the lead service and, as such, will coordinate the model community efforts through TIPPP and act as a point of contact between EPA, DOD, and the other installations.

Although ACC has been designated the lead participant, as a joint cooperative effort, TIPPP has no defined command relationship between the participating organizations.

FORMAL COMMITMENT OF PARTICIPANTS
A memorandum of understanding signed by the Army, Navy, Air Force, and NASA 6 Aug 91

This commitment:

- Assigned responsibilities of participants.
- Established EPA Region III as the EPA coordinating office.
- Allowed each installation to implement its own program.
- Called for reevaluation after three years.

Roles of Participants

By its nature, a model community program is conceived as a cooperative effort between various residents within a defined community. Each participant has defined roles vital to the effort's overall success. While the major impetus for implementing and operating the model community program must come from the participating installations, support in program development, technical assistance, research, and technology transfer will come from the participants external to the Tidewater military, DOE, and NASA communities.

The specific roles of the installations include:

- Identify waste-generating processes that might provide opportunities for reduction.
- Select the pollution prevention projects to be developed.
- Train installation personnel in pollution prevention and energy conservation concepts and the use of new technology.
- Implement the program, including process modifications.
- Administer and monitor specific pollution prevention projects.
- Provide EPA, DOD, and DOE with the results of the projects.

Community Involvement

Each TIPPP participant has a strong commitment to community involvement in pollution prevention both on and off the installation. TIPPP installations work closely with community organizations such as The Chesapeake Bay Foundation and the Newport News Clean Community Commission to sponsor recycling efforts and participation in activities including "Earth Week" and the annual "Clean the Bay Day." Additionally, TIPPP outreach briefings have been given to the Hampton Clean City Commission, the Virginia Department of Waste Management, and the Virginia State Senate Sub-Committee On Pollution Prevention.

Program Summary

The TIPPP includes the individual pollution prevention programs of the participating installations and cooperative

efforts between participating facilities and support activities from participants external to the demonstration area (EPA, the State of Virginia, DOD, and DOE).

As an ongoing pilot program, TIPPP's immediate purpose is to improve the efficiency and environmental quality of the participating installations. Through the TIPPP program, EPA assisted the installations in developing and implementing a pollution prevention institution that will continue to function after the initial demonstration program. Finally, the program is providing EPA, DOD, and DOE with pollution prevention techniques and strategies transferable to other installations. The program envisioned by the participants would be developed and implemented over a three-to-five-year period.

TIPPP, by design, is an ambitious undertaking to apply pollution prevention concepts to energy production/usage, industrial processes, residential/municipal wastes, and natural resource conservation and land management programs at the four participating installations. TIPPP is designed to augment existing pollution prevention efforts as well as initiate new projects at each installation.

Installation-specific program plans recognize each installation's unique circumstances and issues. The four installations have distinctive industrial processes, institutional arrangements, and different natural resource management issues and environmental challenges. Despite these differences, all the installations have many unifying commonalties.

The formal and informal links between the installations forged by TIPPP form the basis of the model community program. Program plans and projects provide a common pool of information and understanding on pollution prevention techniques, technologies, and strategies. Each independent installation shares responsibility for and supports activities of the model community. This includes sharing information, research, and testing results; jointly funding/supporting projects; addressing common problems; or holding interinstallation training sessions.

Each installation has prepared a pollution prevention management plan for its program. For example, the plan for Langley AFB addresses pollution prevention goals and objectives, organization and responsibilities, program elements, waste minimization opportunity assessments, and reporting and tracking. It also includes strategies for short- and long-term fixes, comprehensive base planning, energy conservation, natural resources, and training materials for senior staff, industrial workers, and military family housing occupants.

Program Objectives (Achievements)

To pursue environmental protection through pollution prevention, DOD, along with other federal agencies and local communities, must develop a new attitude toward generating and disposing waste. Specifically, to shift focus to preventing pollution, TIPPP objectives are to:

- Change the way people think about wastes and begin to regard them as valuable resources. **(TIPPP has been very successful in recycling initiatives. All TIPPP installations have programs in place and participation from military and civilian communities is in line with a 25% reduction goal by 1995.)**
- Create a framework within institutions, both public and private, to promote pollution prevention to the fullest extent. **(Although all are not fully staffed for pollution prevention at this time, installation environmental programs provide the foundation for pollution prevention activities. TIPPP initiatives have done much to foster development of community programs such as the Newport News Clean Community Commission.)**
- Develop a spirit of cooperation to permit an easier flow of technical information and innovation to do what is best for the environment. **(Monthly meetings and frequent contact via telephone allow the timely exchange of information and ideas between participants.)**
- Refocus funding and resource priorities toward developing and implementing pollution preventing and resource conserving technologies, management practices, and regulations. **(TIPPP funding has been used to foster innovation and implement new ideas. TIPPP is continuing to work within the framework at each installation to improve command interest and priority of environmental program funding.)**
- Foster a new value system where governments, businesses, households, academic institutions, and all other sectors of society place a high value on protecting our environment and natural resources through the reduction in the amount of waste we produce or adverse environmental impacts we create. **(The participation of over 1,500 volunteers from TIPPP installations during "Clean the Bay Day" demonstrates the degree of individual ownership placed on protecting our environment.)**

The TIPPP is designed to foster these concepts and identify methods to incorporate prevention into a well-defined community.

Specific TIPPP goals include:

- Support the environmental missions of each installation.
- Provide a proving ground for various pollution prevention and energy conservation techniques.
- Provide information that will be used to develop guidance materials for other installations (or other communities) that might wish to establish a community-wide pollution prevention effort.
- Create a pollution prevention framework that will continue to function long after the pilot program.

TIPPP Successes

As a pilot program, TIPPP has enjoyed great success at each of the participating installations. The ongoing initiatives continue to expand in reach and community participation. Increased awareness and tangible results ensure the continued growth and development of the TIPPP.

TIPPP's most outstanding feature and greatest accomplishment

JOINT COOPERATION OF THE ARMY, NAVY, AIR FORCE, NASA, AND DOE, TO FOSTER INNOVATION AND DEVELOPMENT OF SOUND POLLUTION PREVENTION PRACTICES THROUGHOUT THE TIDEWATER AREA

Process Modification and Improvements

Non-Solvent Parts Washers

Non-solvent parts washers have been demonstrated at three TIPPP military installations. The washer, which uses water and

detergent, was highly effective in removing grease and other materials from aircraft and vehicle parts. The idea was so well received that TIPPP personnel at Fort Eustis added other products and processes demonstrations designed to replace hazardous materials:

- The washer was installed at the Naval Base Norfolk, Ship Intermediate Maintenance Facility, at a cost of $10.6K.
- First year savings:

Canceled Solvent Contract	$ 20K
Canceled Rags Contract	$ 4K
Reduced Process Time (87%)	$118K
TOTAL	$142K

Information on the parts cleaner has been made available, and ACC has provided funds for washers at its bases. Luke AFB, Arizona, has installed the washer and is experiencing the same results as Naval Base Norfolk. The Navy has installed washers on some ships, and additional washers have been ordered for TIPPP participants.

Plating Shop

At the Naval Base Norfolk Plating Shop, a number of changes have made a dramatic difference in the generation of hazardous wastes. It achieved a huge success after installing counter current rinses; electrolytic oxidation recovery units for cadmium, silver, and nickel; and modified operating procedures:

- Rinse water use has dropped from approximately 150,000 gallons per day to 10-15,000 gallons per day.
- Greater than 99% of the cadmium, silver, and nickel in the rinse water is recovered and reused.
- Approximately 4,000 pounds of hexavalent chrome are projected to be recovered from the ventilation system each year which will also be reused in the plating process.

Improved Material Management

Recycling

One of the most tangible aspects of TIPPP has been in the recycling efforts of its participants. Recycling programs are in place at all TIPPP installations and are being expanded to include all personnel and activities. The military family housing areas participate in the regional curbside recycling program. Recycling goals are being established and the program advertised through awareness briefings and newspaper articles.

Through such recycling initiatives, TIPPP installations helped each community to recycle 15% of its newspapers, corrugated cardboard, plastic, aluminum, steel, and glass waste in 1993. They plan to reach a goal of 25% by 1995. Although detailed figures are not yet available, recycling efforts are showing great support from installation personnel and planned objectives should be readily attainable.

Household Chemicals

Through TIPPP, Langley AFB instituted a household chemical pollution prevention program:

- Departing personnel can turn in excess household chemicals at two central locations.
- Turned-in materials are offered to new arrivals at no cost.
- There is reduced disposal of potentially hazardous chemicals that are often not disposed of properly with an **estimated savings of $15K per year.**
- A similar program is being developed for five naval housing areas at Naval Base Norfolk.
- ACC is exporting this success to all ACC bases.

Fuel Spill Recovery Systems

Fuel spills are the second largest hazardous waste stream at ACC bases. Through TIPPP initiatives, a variety of "vacuums" and "Super Soppers" have been acquired for use at ACC bases. Residue is being used for energy recovery. Estimated savings are $25K per base per year and $500K per year across ACC.

TIPPP Pollution Prevention Outreach

Another major success of the TIPPP has been in the enhancement of pollution prevention awareness throughout the peninsula via information exchange and community activities.

Information Exchange

Monthly meetings and frequent contact via telephone allow the timely exchange of information and ideas between participants. Successes and failures of selected initiatives are reported to the program coordinator, who consolidates the information and submits it to higher headquarters and the EPA. This information is crossfed to other military installations for implementation within their own pollution prevention programs.

Opportunity Assessments

EPA has supported the TIPPP by conducting opportunity assessments at the participating facilities. These assessments were systematic, planned procedures with the objective of identifying ways to reduce or eliminate the generation of wastes. Activities that have been assessed include:

- Aircraft Corrosion Control.
- Vehicle Maintenance.
- Vehicle Paint Shop.
- Air Field Runoff.
- Land Management/Nutrient Reduction.
- Machine Coolants.
- Plating Operations.
- Reclaiming Blast Media.
- Laboratory Wastes.

Additional assessments are being conducted at all participating installations by contractors and in-house teams.

Fact Sheets

EPA has published a number of Pollution Prevention Fact Sheets that are based on these, and other, opportunity assessments. The sheets describe a problem, provide comments on different approaches to solve the problem, and give references for further information. They have also published a handout on the TIPPP.

The significance and value of opportunity assessments can be demonstrated by examining the results of the assessment at Langley AFB. Recommendations were made that can, when fully implemented, result in a reduction of several thousand gallons of hazardous wastes, eliminate thousands of pounds of volatile organic compounds (VOCs), and save over $100,000 in raw material costs and hazardous waste disposal expenses per year.

Generic Pollution Prevention Management Plan (PPMP)

A generic PPMP, which was distributed to installations Air Force wide and to other DOD and federal agencies, was prepared from the specific plan developed for Langley AFB. The plan:

- Provides basis for installation specific plans and eliminates need for outside contractors to write plans.
- Predicts estimated savings of $750K at ACC installations.

Pollution Prevention Awareness Video

A pollution prevention awareness video was made at Langley AFB as part of the TIPPP funded PPMP. It focused on what military families can do to prevent pollution through:

- Proper disposal of household chemicals.
- Recycling.
- Pollution prevention awareness.

Filmed at Langley AFB, the video can be used at any DOD installation.

Pollution Prevention Equipment Books

HQ ACC TIPPP personnel developed information packages on state-of-the-art pollution prevention equipment available to DOD agencies. The packages were forwarded to TIPPP installations and other DOD activities. Many items were purchased with FY 92/93 supplemental pollution prevention funds.

With modern equipment and sound pollution prevention practices, payback time is projected at less than 3 years.

Community Involvement

As a joint cooperative effort, TIPPP transcends the individual efforts of the participating agencies. Each TIPPP installation is working closely with local civic leaders to help promote sound pollution prevention practices and reduce TIPPP installations' contributions to municipal waste streams. Collectively, the TIPPP installations are making significant impact on community pollution prevention awareness across the peninsula. The military installations specifically have helped sponsor and participated in large-scale peninsula-wide community involvement activities such as Earth Week and Clean the Bay Day activities.

All TIPPP installations participated in "Earth Week '92." Activities included free emissions testing for privately owned vehicle (POVs), environmental awareness presentations for kids, and "How Can I Be More Environmentally Conscious?" presented by the Virginia Marine Science Museum. The 5th Coast Guard District gave presentations on oil spill cleanup techniques.

Clean the Bay Day is an annual event sponsored by the Chesapeake Bay Foundation, which gives local community members an opportunity to participate in the environmental restoration of the Chesapeake Bay. Volunteers participate by sponsoring specific areas for cleanup. Last year over 1,500 volunteers from the Tidewater military installations collected in excess of 30 tons of trash along the Chesapeake shoreline.

Newspaper articles and briefings to senior leadership in the Tidewater area have been used to heighten the awareness of all installation personnel. TIPPP personnel have presented the TIPPP concept and successes to many organizations, including:

- Chesapeake Bay Workshop.
- Virginia III Environmental Symposium.
- TAC Environmental Quality 92 Workshop.
- Federal Facilities Conference.
- Society of American Military Engineers.
- Virginia Senate Subcommittee on Pollution Prevention.
- DOD Hazardous Material Pollution Prevention Committee.

The Future of TIPPP

Long-term success of the program will depend upon how well personnel and residents embrace the concepts and integrate them into their daily activities. Prevention technologies alone will not ensure success of the entire program. TIPPP will continue to lead in the efforts to restore the Chesapeake Bay through:

- Demonstrating specific pollution prevention concepts through technical projects.
- Conducting training and outreach efforts.
- Identifying measures of success.
- Tracking progress of pollution prevention programs.
- Cross feeding successes.

Tim Blevins is Outreach Coordinator, Pollution Prevention Branch, Environmental Programs Division, Langley AFB, Virginia.

CAREER AND PERSONNEL INFORMATION

Logistics Professional Development

The AFIT Selection Process

The Air Force Institute of Technology (AFIT) offers fully funded graduate education for eligible military officers. AFIT graduate programs are offered under the AFIT School of Civil Engineering and Services, the AFIT School of Engineering, and the AFIT School of Logistics and Acquisition Management. Requirements for entry vary depending on the degree, but there are some general rules that apply for all. For the purposes of this article, the focus will be on the requirements and selection process for officers interested in an AFIT assignment in the School of Logistics and Acquisition Management.

AFIT Eligibility

Before officers volunteer for AFIT through their respective assignments officer at the AF Military Personnel Center (MPC), their eligibility must be determined by AFIT. Officers can request an academic evaluation through their local Education Office or contact AFIT directly. Eligibility for AFIT programs is determined by the AFIT Admissions/Registrar (AFIT/RR) in coordination with the School of Logistics and Acquisition Management. AFIT will notify the officers of their eligibility by mail.

Through FY94, the basic eligibility requirements for this school is a grade point average (GPA) of 2.5 on a 4.0 scale for the Bachelor's Degree and a Graduate Records Exam (GRE) score of 500 verbal and 500 math. The Graduate Management Aptitude Test (GMAT) is currently an acceptable alternative to the GRE. Depending on the particular program officers are interested in, either college algebra or one year of calculus is a prerequisite. If their GRE/GMAT scores are too low or the math requirement is not fulfilled, they can correct the discrepancy and request a reevaluation at any time. AFIT/RR maintains a list of officers that are at various stages of eligibility.

There are significant changes in eligibility requirements for the AFIT School of Logistics and Acquisition Management expected for FY95. The school is expected to change GPA and entry test requirements to mirror that of the AFIT School of Engineering. Specifically, the GPA will increase to 3.0 and required GRE scores will rise to 500 verbal and 600 math. In addition, the GMAT will not be accepted in lieu of the GRE. These changes could potentially impact many of the support officers who have been eligible in the past.

AFIT Selection Process

The AFIT academic evaluation is just a small part of the entire process. Eligibility does not mean selection to attend AFIT. For officers to be evaluated for an AFIT school quota, they must contact their appropriate assignments officer at MPC. They may volunteer for a school slot outside their AFSC, such as a Supply officer volunteering for the Transportation Management Degree program. If they do, they must meet the AFIT eligibility requirements for that degree program. Further, they must fulfill their advanced academic degree (AAD) commitment in the AFSC from which the degree was awarded. In other words, officers have the opportunity to get a degree and career broadening. They follow up their volunteer notification to MPC with an AFIT-specific AF Form 90 endorsed by their commander.

Now MPC goes to work. The assignments officer prepares an AFIT package for each potential student to include a quality check from the commander through the MAJCOM, the AF Form 90, verification of AFIT eligibility, and the individual's records. The records pass through several offices which review the record and recommend approval or disapproval for an AFIT billet. Items considered include GPA and GRE scores, total military service, and record. An AFIT student is an investment in the Air Force's future; therefore, officers selected must have a strong record that portends a future career in the USAF.

When all coordination is complete, the MPC AFIT office loads selected officers on assignment and inputs the "EB" assignment block code. The block code forces other offices to coordinate with them prior to any action being taken on the officers.

Assignments for AFIT Graduates

Students in the School of Logistics and Acquisition Management graduate in September, completing a rigorous 16-month program with a Master of Science Degree. Graduates are expected to complete a three-year tour in a position coded by the MAJCOMs for officers with AADs.

In the past, MPC had two tours following graduation to assign officers into AAD billets. A recent Air Force audit, however, discovered that this was not the case and that there was in fact a low utilization of AFIT graduates completing a three-year tour in an AAD billet. The problem is partly caused by the lack of valid AAD billets in particular AFSCs. The result is too many graduates available for too few positions. Each year, MAJCOMs have the opportunity to revalidate/add AAD billets as needed. MAJCOMs are also moving the AFIT officers out of AAD billets once assigned to their unit. As mentioned before, MPC has now placed a block code on AFIT officers to prevent such a move without their concurrence.

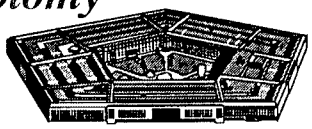
Because AFIT graduates are valuable resources, there has been an increased emphasis on placing officers into AAD billets immediately after graduation. Each student currently in school will be placed in AAD billets on the first tour following graduation, and officers currently being selected for the May 1994 class are being tentatively assigned to AAD billets in conjunction with their AFIT PCS orders.

Preparing for the Future

AFIT will continue to educate quality officers; but for the School of Logistics and Acquisition Management, the standards will be tougher. Commanders should encourage young officers to request an AFIT eligibility evaluation early in their career as well as brief them on the benefits of earning a master's degree with the Air Force. It is a program which can certainly be deemed a career enhancer.

(Maj Cheryl Heimerman, HQ AFMPC/DPMRSL, DSN 487-4024)

Military Logistics and Business Logistics: Reexamining the Dichotomy



Dr Stephen Hays Russell

Introduction

Interest in the divergences and commonalities between military logistics and business logistics was piqued with the 24 September 1993 announcement by Sears that retiring Army Lieutenant General William G. Pagonis, former Deputy Commanding General for Logistics in the Persian Gulf War, was named senior vice president for logistics. The most highly-visible military logistician in recent memory will be redirecting his efforts from strategizing and executing logistical support of a military machine to managing Sears Logistics Services, Inc., the Sears unit responsible for distribution of goods to its 798 stores.

To what extent do military logistics practices apply to the private sector? The conventional perception is that logistics as a discipline is comprised of two very distinct and unique branches: *military* (or systems) logistics and *business* logistics.

This article reviews the origin of business logistics, portrays differences in concept and approach between military and business logistics, and demonstrates that recent trends in business logistics suggest more similarities and congruence with military logistics than is generally perceived.

Origin of Business Logistics

Logistics as a discipline has categorical origins in the military campaigns of history. Indeed, the term itself connotes military science to the extent that *military* logistics is the *only* definition given by Webster. (10)

In the late 1950s, however, a *new* logistics began to emerge as business leaders and academicians recognized the value of applying military logistics concepts and technologies to the physical distribution of products. This migration of logistics management to the private sector was facilitated by a number of factors. These included recognition by the marketing profession that its preoccupation with product promotion was at the expense of too little emphasis on product distribution, and the development of linear programming and other logistics quantitative methods by the military with clear application to private sector distribution issues. Additionally, the economic climate in the 1950s, with rising real incomes and an expanding variety of products, was ripe for methodical focusing on distribution issues.

The first book to systematically address private sector logistics, *The Role of Air Freight in Physical Distribution*, was published by the Harvard Business School in 1956.* (6) The first textbook, *Business Logistics,* appeared in 1964. (2)

Formal attention to business logistics issues within corporations and the creation of corporate logistics organizations began to emerge in the late 1950s. Pioneers in this trend were Sylvania, Nabisco, Boise Cascade, and H. J. Heinz among others. (4) (Sears is a recent addition to the growing number of private-sector firms who have created logistics organizations.)

Practitioners of the new logistics established the first professional organization for business logisticians, the National Council of Physical Distribution Management, in 1963. The name was changed to the Council of Logistics Management (CLM) in 1985.

The first college degree program in business logistics was introduced in 1965 by Pennsylvania State University. This curriculum defined business logistics as (1) materials management in support of production, and (2) inventory management, warehousing, and transportation in support of distribution of finished goods.

As a formal discipline and career field, business logistics today is concerned with the efficient management of materials and products into, through, and out of a firm to support customer requirements.

The Two Logistics

As a result of the private sector adaptation of logistics, the prevailing logistics paradigm is that the discipline has two branches: *military logistics* and *business logistics.* Each branch is viewed as legitimate logistics because its core is the basic logistics functions of materials acquisition, management, and distribution. Beyond this commonality, however, the branches are conventionally viewed as being very different with each having its own terminology, models, objectives, processes, professional literature, educational programs, and distinctive practitioners.

Table 1 models the existing paradigm. Perhaps the most noticeable distinction between the two branches of logistics is objectives. Whereas military logistics emphasizes operational readiness with support of troops and their equipment, the objective in business logistics is profit.

Military logisticians focus on reliability and maintainability engineering and supporting fielded systems. Business logisticians are concerned with differentiating their firms in the market by good customer service (reliable, efficient distribution of product).

Logistical support for a weapon system begins with system design. In business, the logistics process begins with a forecast of demand for finished products, which gets translated into production schedules, material requirements, and distribution plans.

Aside from issues of readiness and sustainability, the decision framework in military logistics is life cycle costs; for the business logistician the decision framework is assessing the trade-off between logistics service levels and logistics costs with the omnipresent objective of profit.

*I wish to thank Professor Bernard J. La Londe of Ohio State University for bringing this book to my attention.

Conventional Logistics Paradigm

	Military Logistics	*Business Logistics*
Objective	Operational Readiness via Support	Profit via Superior Customer Service
Focus	Logistics Engineering Acquisition Strategies Life Cycle Costing Systems Support	Materials Planning Strategic Alliances Distribution Customer Service
Starting Point	System Design	Demand Forecasting
Decision Framework	Life Cycle Costs	Cost-Service Trade-off
Principal Subdisciplines	Reliability Engineering Provisioning Configuration Management Supply Management Maintenance Transportation	Materials Management Order Processing Inventory Warehousing Industrial Packaging Physical Distribution
Model	Integrated Logistics Support (ILS)	Supplier-Firm-Customer Pipeline
Customer Type	Internal	Internal and External
Performance Measures	Service Levels Readiness Rates Sustainability	Order Cycle Time Order Fill Rates Delivery Reliability
Professional Society	Society of Logistics Engineers (SOLE)	Council of Logistics Management CLM)
Registered Professionals*	5482	8680
Principal Academic Programs	Air Force Institute of Technology (AFIT) Naval Post Graduate School Colorado Technical College Weber State University	Arizona State University Michigan State University Ohio State University Pennsylvania State University University of Tennessee

*As of 6 January 1994

Table 1.

As a model of the process to be managed, the business logistician looks at a logistics pipeline with suppliers to the firm's manufacturing operations at one end of the pipeline and wholesale customers at the other end. The military logistician sees his model as one of integrated logistics support—from the system design stage through the development, acquisition, and delivery of support requirements.

In terms of customer type, the military logistician's customer is internal—military forces. The business logistician services both internal and external customers. The internal customer is the firm itself. Logistical support of production is called *inbound* logistics. The external customer is the wholesale customer of the product. Logistical support of customer requirements is called *outbound* logistics.

According to General Pagonis, the biggest difference between military and business logistics is the bottom line—life and death versus profits:

> We in the military must sacrifice some measure of efficiency to maintain a higher margin of safety. We stockpile a little (or a lot) extra just in case. We build. . . redundant system[s]. . . . (8:210)

General Pagonis notes that corporations cannot afford these margins and redundancies.

New Similarities Between Military and Business Logistics

Notwithstanding that military and business logistics have their own identities as different branches of the discipline and have largely gone their own way for many years, recent developments in business logistics suggest new similarities in terms and approaches.

A review of contemporary and emerging practices in business logistics reveals a remarkable convergence of concepts and terms. Consider these examples of traditional military logistics concepts now finding root in private sector logistics:

(1) *Life cycle.* Business logisticians are now addressing product life cycles as a logistics issue as they recognize the importance of controlling pipeline inventories on the basis of product life cycles. Specifically, a firm marketing a new product at risk of being overtaken by a new model or technology must be careful not to tool up for or produce much of a logistics tail.

(2) *Cycle time.* As a measure of customer service performance, business logisticians are concentrating on reducing cycle times, which they define as order placement to order delivery. Wal-mart's logistics strategy with certain suppliers is specifically focused on driving cycle times to zero with *integrated logistics support.*

(3) *Integrated logistics support (ILS).* Leading-edge logisticians in the private sector are creating what they call *seamless* logistics processes. (9) This term refers to the creation of partnerships among firms in the business logistics pipeline (from supplier to manufacturer to wholesale customer) with such a degree of integration that the pipeline flows automatically.

The ultimate in integrated logistics support in business applications is alliances between suppliers and the manufacturing firm and alliances between the manufacturing firm and the wholesale customer. In the first alliance, the supplier of inputs is responsible for monitoring the firm's production schedule and for writing orders on itself to support the manufacturing firm's requirements.

In the second alliance, the manufacturing firm is responsible for monitoring and managing inventories of its customers without the customer placing orders. This concept was pioneered by Wal-mart when it negotiated an agreement with Proctor and Gamble for both products and logistics; i.e., Proctor and Gamble is to manage Wal-mart inventories of Proctor and Gamble products without Wal-mart's assuming any responsibility for order placement, warehousing, or transportation—ILS at work in the private sector.

(4) *Redeployment* or *retrograde logistics.* General Pagonis refers to redeployment logistics when he writes of turning the Gulf War logistics machine from a "fire hose" into a "vacuum cleaner" when the war ended in just four days. (8:150) In 1993 business logisticians coined the term *reverse logistics* for a similar concept in their branch of the discipline. (5)

Reverse logistics is defined as the recall, the reuse, or recycling of products. Examples would be a chemical supplier recapturing empty drums from customers or customers returning spent lead batteries to the manufacturer. In many circumstances, customers are demanding reverse logistics from their suppliers. This is especially true in the case of hazardous materials and their containers.

An interesting case of forced reverse logistics is the federal law in Germany which requires all exporters to Germany to take their packaging materials back out of the country.

(5) *Life cycle cost.* Business logisticians are just beginning to employ this important term borrowed from military logistics. The concept is being used in three contexts. One is the idea that the fewer materials a firm has going through procurement, manufacturing, and delivery (that is, smarter buying, less waste, lighter packaging), the lower the product's life cycle cost to the manufacturer and distributor.

Another context of life cycle cost in business applications is with respect to reverse logistics. Having products or containers returned for reuse or recycling often reduces life cycle cost to the manufacturer.

The third contextual use of life cycle cost mirrors the military use of the term: Trading off increased current costs for lower long-term total costs. Business logisticians are being forced to include potential product liability into long-term product costs, particularly with regard to environmental impact. They are now assessing trade-offs of up-front costs (environmentally friendly packaging materials, for example) for lower life cycle costs that incorporate environmental and other product liabilities. (5)

(6) *Logistics engineering.* Whereas military logisticians use the term *logistics engineering* to refer to trade-off studies (particularly with regard to investing in system reliability), business logisticians are now using the term to refer to the redesign (reengineering) of logistics processes. (9) The concept is to start figuratively with a clean piece of paper and reengineer all logistics flows and activities to remove all non-value added activities. The objective of logistics engineering in business applications is achieving existing customer service levels at lower costs or achieving higher levels of customer service for existing costs (which itself is a classic military logistics constrained optimization problem).

In both military and business logistics, the term *logistics engineering* relates to studies on increasing system performance.

(7) *Demand.* Military logisticians have for years recognized the importance of demand forecasts placed on the logistics system and of the response to those demands. Business logisticians now recognize the critical importance of demand forecasts in their branch of the discipline.

At one time, business logisticians looked at business logistics as a series of fragmented activities (order processing, inventory control, transportation, etc.). However, in the last 20 years, practitioners have come to see business logistics as a strategic process ripe for coordinated improvement. With this realization, demand forecasting has loomed large. Business logisticians recognize that this is where the whole business logistics process starts: Demand forecasts are compared to finished goods inventories, production requirements and schedules are developed, and the logistics process is turned on (initially for inputs; ultimately for finished goods distribution).

(8) *Contingency planning.* Although business logistics does not incorporate the type of contingency planning reflected by such military practices as war readiness spares kits and prepositioning of supplies, a field of quasi contingency planning in business logistics is emerging under the concept of Service Response Logistics (SRL).

Business logisticians have traditionally viewed logistics processes as being triggered by some activity as opposed to being preplanned for a contingency (event). As examples, in traditional business logistics, a master production schedule triggers order placement for inputs, or an end-of-the-month inventory count triggers reorders.

Under the emerging SRL concept, however, companies—as a form of contingency planning—have in place an infrastructure of core competencies to anticipate and to respond uniquely to individual customer needs. The idea is to have a series of conditional protocols ready so that, when the customer calls (the contingency arises), a diagnosis is made, a protocol for those particular conditions is identified, and the appropriate logistics services are immediately executed.

Professor Frank Davis, University of Tennessee, a pioneer in SRL thinking, describes the recent development of firms *planning* to respond with tailored service according to previously developed protocols as moving business logistics closer to the logistics practiced by the military. (1)

(9) *Logistics database.* Until recently, business logisticians have had nothing comparable to the database of the Logistics Support Analysis Record (LSAR). However, business logisticians are now implementing a similar concept in which all participants throughout the logistics pipeline for a product group share databases for coordinated decision making. Just as the LSAR is the consolidated and common database for identifying and managing evolving logistics support requirements in the military, the new common databases in business logistics are

also facilitating coordination in identifying logistics requirements.

Under this new database concept, on the outbound side of business logistics, manufacturers will be taking the initiative to replenish the inventories of their distributors by linking their inventory replenishment activity to both the distributors' business plans and to actual daily sales of those distributors. This linking of databases provides the manufacturer with real-time visibility into inventory balances on every product in the distributor's facilities. On the inbound side of business logistics, this inventory visibility will be used to drive the manufacturer's production and materials requirements.

Another database example is corporate field personnel (both sales and service) using wireless communications devices and portable computers to send and receive information wherever they are on parts availability and location.

The bottom line of the new database concept in business logistics is that real-time customer information via linked databases will drive pipeline management in a highly responsive way.

(10) *Logistics commanders.* The military attaches sufficient importance to logistics as to create formal logistics organizations and to appoint logistics commanders to direct them. The private sector is following suit. A contemporary trend in large firms is the integrating of logistics functions (purchasing, materials management, inventory control, transportation, order processing and distribution, etc.) into a discrete logistics organization and appointing a director or a vice president of logistics. Recent examples of firms who have appointed logistics "commanders" include Morton International, Levi Strauss Company, Spreckels Sugar, Frito-Lay, and Sears.

(11) *Suboptimization.* Military logisticians have long recognized the risks of suboptimization. Indeed, one of the principal purposes of ILS is to preclude suboptimization in decision making during the system's acquisition process.

General Pagonis describes a classic example of suboptimization during the Gulf War. Stateside shippers, eager to fill every container to the brim and thereby ensure that every ship was filled to capacity, designated multiple consignees for a single container. Receivers at the dock in Saudi Arabia had to open 28,000 of the 41,000 arriving containers right on the docks to sort things out. This in-theater processing of containers was a major headache and a lesson learned on the advantages of twenty-equivalent unit (TEU) containers as opposed to the forty-equivalent unit (FEU) containers actually used. (8)

Business logistics practitioners have their own horror stories of suboptimization and are taking the same "systems view" of logistics as the military to preclude suboptimization. A heroic example of proactive logistics decision making in the private sector to preclude suboptimization is the decision by General Motors to charter Boeing 747s to air freight the Cadillac Allante body, designed and manufactured by Pininfarina in Italy, to Detroit. Cheaper ocean-going freight was determined to be suboptimal. (The capital tie-up in pipeline inventory for air freight was $4.5 million—150 bodies—as compared to $30 million—1,000 bodies—if General Motors had decided to ship the bodies by sea.) (3)

(12) *Contractor versus organic support.* Under certain circumstances, military logisticians recognize the need for contracted logistics support on either an interim or permanent basis. Business logisticians, on the other hand, have traditionally kept logistics operations in-house (with the exception of contracting for transportation services). However, an accelerating trend today in the business community is contractor-provided logistics support to firms. More and more firms are going to one of the 50 or so nationally prominent logistics vendors for "third party logistics" support. (7) The primary reason for contractor logistics support in the private sector is the same as in the military: efficiencies and economies under certain circumstances.

Summary and Conclusion

The discipline of logistics is practiced in two camps. Military logisticians deal with an internal customer and concentrate on system readiness and sustainability. Design for supportability is a key element. Business logisticians deal with internal and external customers and focus on profit. The cost-service trade-off is a key element.

This paper has shown that even with the unique objectives and characteristics of the two logistics, there is an emerging similarity and convergence in terminology and concepts. This is both uncanny and insightful: uncanny because the common perception is that these two branches are highly differentiated; insightful because it can now be recognized that the wide chasm that seemingly separates these two aspects of the discipline may be more perceptual than real. As a minimum, the differences are narrowing and are seemingly more of focus than of fundamentals.

Both branches of the discipline have common logistics elements—inventory control, warehousing, packaging, transportation, distribution, etc. Both take a systems view of logistics. Both are now concentrating on issues of demand, databases, design, life cycle, and integration, although the focuses may vary. Both have a growing common vocabulary. Both look to logistics commanders for coordination, planning, and the avoidance of suboptimization in logistics processes.

It is not surprising that Sears and other firms turn to seasoned military logisticians for logistics leadership in the private sector. The old dichotomy is getting fuzzy.

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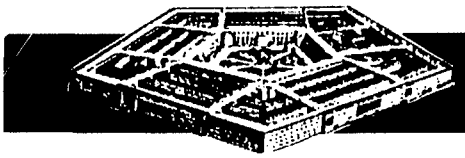
Dr Russell is presently Assistant Professor of Logistics, Business and Economics-Business Administration, Weber State University, Ogden, Utah.



USAF Logistics Policy Insight

Movement of Classified Freight

Recently, the Air Force and the Defense Logistics Agency received authorization from the Office of the Secretary of Defense (OSD) to test an express carrier for the door-to-door movement of classified freight. The six-month CONUS test, which began 1 December 1993, will evaluate the cost and service provided by the express carrier compared to cost and service provided by the more traditional ways of moving classified freight (United States Postal Service/government/dromedary truck). During the test, classified freight will move via express carrier from any one of the five Air Logistic Centers direct to any active, guard, or reserve base. The return movement of classified freight will be deliberately limited to only those bases currently involved in the implementation of two levels of maintenance. Air Force officials say this is necessary to keep the scale of the test within scope so the Air Force can satisfy data requested by OSD.

Historically, long-standing DOD policy imposed restrictions which greatly limited the traffic manager's carrier selection and options to move classified freight. These restrictions often resulted in movement delays and, depending on the mode selected, were costly. Last summer, AF/LG identified the movement of classified freight as a potential Defense Performance Review initiative. It was through this forum that senior DOD and Air Force leadership noticed that a change in the policy could improve efficiencies and lower costs at the same time. Security of moving classified freight is kept intact by the speed with which the freight moves (overnight) and the "real-time" in-transit visibility offered by the commercial small package industry.

The concept of movement is simple—the freight moves fast. High-velocity movement greatly minimizes the opportunity of a potential compromise. Furthermore, we can track the freight on a real-time basis as it moves through the carrier's system. The carrier has no idea the contents of a particular package is classified. The freight is offered as generic cargo; hence, there is no requirement for specialized services which further reduces the cost of movement. We see the door-to-door movement of classified freight as a significant improvement in how we support our customers. Our initial efforts have been to focus on CONUS operations; in the near future, we will be addressing how we best can expedite the movement of classified freight to our other-than-CONUS (OCONUS) customers.

(Lt Col Mark Quigley, AF/LGT, 223-9836)

CURRENT RESEARCH

Air Force Materiel Command (AFMC) Management Sciences Study Program

The AFMC Management Sciences Division (AFMC/XPS) is responsible for developing, managing, and executing Headquarters Air Force Materiel Command's management sciences program. Our function is to provide a source of operations research skills for the Headquarters. Although we are a part of the Directorate of Plans and Programs, we often perform studies and analyses for clients outside the Directorate. We work closely with our customers as we design and perform studies to ensure we have a healthy balance between the rigorous application of operations research techniques and practical solutions that can be implemented. We have focused our efforts on the development and enhancement of mathematical models that can relate materiel resource decisions to impacts on weapon system availability so AFMC can prioritize and justify its investments in resources. We work toward relating resources to availability by performing studies for our customers and by pursuing a few internally developed projects that have significant potential for providing valuable insights into these relationships. In 1993 we continued to emphasize four major areas—Distribution and Repair In Variable Environments (DRIVE), Weapon System Management Information System (WSMIS) enhancements, Engine Pipeline Studies, and the cost and responsiveness implications of a number of specific alternatives designed to reduce logistics costs. We also were involved in (a) improving AFMC business practices to posture AFMC for the future; (b) assisting AFMC, and the Air Force, with the transition to two levels of maintenance; and (c) working with the Joint Logistics Systems Center (JLSC) to develop and deploy assessment and requirements processes that can be used throughout DOD.

The senior staff consists of:

Mr Victor J. Presutti, Jr., Chief, DSN 787-3201

Mr Curtis E. Neumann, Analytic Applications Function, DSN 787-6920

Ms Barbara Wieland, Concept Development Function, DSN 787-7408

Miss Mary E. Oaks, Study Program Manager, DSN 787-4406

Distribution and Repair In Variable Environments (DRIVE). We continue to provide model and technical support for the implementation of DRIVE. Our main focus is AFMC applications, but we also support related uses such as regional repair centers and Lean Logistics efforts. Our project workload is shifting from DRIVE as a stand-alone system to its integration into depot processes. The main goal is to use DRIVE to automate and implement process improvements that will result in significant resupply time reduction.

We use a PC-based version of DRIVE called DeskTop DRIVE as one of our main analysis tools. DeskTop DRIVE also serves Air Logistics Centers (ALCs), major commands (MAJCOMs), AFMC Detachment 35 at Kadena AB, Japan, and regional repair center repair and distribution prioritization activities. It augments the mainframe Production System and has been a cornerstone of DRIVE's success in the two-level maintenance implementation at Ogden Air Logistics Center (OO-ALC) and Oklahoma City Air Logistics Center (OC-ALC).

Our 1993 model enhancements added nonflying hour capability, supported the war-fighting metrics initiative, and provided dual depot source of repair (SOR) recognition as directed by the two-level maintenance dual organic repair edict. Dual organic SOR and recognition of a regional repair echelon (model enhancements completed last year) were implemented in the AFMC DRIVE Production System. Our analysis projects covered data issues (D035C versus standard base supply system asset data and configuration data impacts on DRIVE), the DRIVE distribution field test at OO-ALC, Production System design issues (Air Mobility Command (AMC) Forward Supply System changes and Foreign Military Sales support), and depot process improvements (Depot Express System Interface, Automating DRIVE Distribution, and Depot Awaiting Parts Policy).

Our 1994 work will continue the theme of integrating DRIVE into depot processes and using it for process improvements which result in pipeline reductions. Automating DRIVE distribution, level setting, and DRIVE Production System enhancements rank high on the list. We also anticipate involvement in DRIVE applications to banding for repair, Lean Logistics, and Air Combat Command's (ACC) B-1B test. (Analyst: Bob McCormick, DSN 787-6920)

Aircraft War-Fighting Metrics. During Desert Storm and ever since that time, AFMC has recognized the need for a tool which predicts readiness for a six-month war based on today's asset posture (recoverable spares for aircraft). We designed and developed a system which forecasts achievable sorties for both a 30-day war and a 180-day war. The intent is to quickly identify weapon systems which are likely to have spares support problems and to determine which parts need immediate management attention. The assessment system can be used during peacetime to measure performance and help with planning; also, it can be used during wartime to develop depot surge lists and get-well plans. Initially, the metrics will be used to prepare status charts for the quarterly AFMC Horizons Conference.

The 30-day war-fighting metric is based on the WSMIS Sustainability Assessment Module (SAM) capability assessments of approximately 300 units, which are generated weekly. The model is fairly simple because the Air Force assumes that there will be no depot support and little or no base repair. Parts break based on hours flown and, generally, spares are applied until they run out. 180-day war modeling, however, is much more complicated because we need to consider all the spare parts in the world, including carcasses (broken parts), base and depot level repair, and depot spares distribution. Our war-fighting metric assessment system does this by tapping into DRIVE to model the depot repair and distribution processes, and then assessing the readiness of each type of aircraft by applying Dynamic Multi-Echelon Technique for Recoverable Item Control (Dyna-METRIC). (Analysts: Mike Niklas, Karen Klinger, Chris Dussault, Bob McCormick, DSN 787-6920)

Analysis of C-17 Engine and Module Maintenance Locations. The objective of this study is to provide the C-17 System Program Officer (SPO) an evaluation of five maintenance location options for the C-17 engine and modules. The maintenance

options are organic depot overhaul with two module replacement centers (MRCs), organic depot overhaul with one MRC and one quick engine change (QEC) center, organic depot overhaul with two QECs, contractor logistics support (CLS) overhaul with two MRCs, and CLS overhaul with two QECs. Our goal is to provide insight into operational impacts, such as operational readiness and repair bottlenecks, that will assist the C-17 SPO in making smarter decisions about maintenance concepts for the C-17 engine and modules. Simulation techniques are being used to address the details of the removal and replacement of whole engines from the aircraft and modules from the engine, and their respective movement throughout the entire logistics system. The simulation models being developed transition from peacetime through wartime (surge and sustained) scenarios. (Analysts: Harold Hixson, Tom Stafford, DSN 787-7408)

Logistics Enhancement Awareness Development (LEAD). In June 1993, AFMC/XPS awarded a contract to Kapos Associates, Inc., for the development of a wargaming training/exercise program that effectively reflects how operational logistics considerations shape a wartime scenario. It is designed to provide senior officers with basic knowledge about, and the feel for, the role of operational logistics in wartime situations. The program is a series of mobile seminars with an embedded wargame emphasizing operational logistics in present and future combat operations. The objective is to develop the logistics awareness senior officers will need for sound planning and decision making while making only modest demands on their schedule. At the completion of the contract, the seminar material will be turned over to Air University for inclusion in their curriculum.

To date we have had two validation seminars with feedback to the contractor. The 9th and 12th Numbered Air Forces (ACC) and the 15th Numbered Air Force (AMC) are also preparing to host LEAD seminars in 1994. (Analyst: Capt Richard Moore, DSN 787-6920)

Joint Logistics Systems Center (JLSC) Support. Our office is a member of the JLSC "math models group" tasked in a joint DOD effort to devise common requirements models to be used by all DOD components. We are being funded by the JLSC to work specifically in the area of multi-echelon, readiness based sparing (RBS) techniques that could be applied across all components. Up to now, the Air Force is the only component to use such a model in a production mode. One approach for a common RBS model that can potentially be acceptable to all components is called multi-link. The Army is designated to lead the multi-link development. We are evaluating this proposal to thoroughly understand its implications for Air Force weapon system support. In addition, if this concept becomes the standard DOD requirements model for replenishment recoverables, we must ensure the Air Force does not lose its capability of getting maximum aircraft availability for a given level of dollars spent. (Analysts: Bill Morgan, Fred Rexroad, DSN 787-6920)

Lean Logistics Support. Lean Logistics is an Air Force initiative to speed up the repair, procurement, and transportation processes to provide better support to the end users at the lowest possible cost. All process improvements developed under the two-level maintenance initiative will be incorporated or further developed under Lean Logistics. Our office is supporting Lean Logistics in a number of ways. We participated on a team that used theory of constraints (TOC) tools on the reparable portion of the logistics process to identify core problems (depots tie efficiency to how busy they are rather than to repairing the right items) and to propose potential solutions (use the DRIVE model to better tie what the depot repairs to aircraft availability). We have continued this support by helping design a test of the buffer stock concept of pulling most of the stock back from the bases into a centralized buffer with very fast transportation back to the bases as needed. We expect to be heavily involved in the level-setting portion of these buffer tests. We also have been using the Aircraft Availability Model (AAM) to test the effects of shortening resupply times on the peacetime spares requirements computation. (Analysts: Barbara Wieland, Fred Rexroad, Bill Morgan, 1Lt Rob Block, DSN 787-6920)

Aircraft Availability Model (AAM) and Banding for Aircraft Effectiveness. AFMC received considerably less FY94 obligation authority for procurement of reparable spares than requested. Because of concerns about how to allocate the limited obligation authority, AFMC established a priority system that created bands of priority for all Air Force weapon systems based on force activity designators and precedence ratings. The production version of the AAM in the recoverable spares computation system was unable to use the banding approach to spread the limited funding. XPS has a research version AAM that mimics AFMC's production version of the AAM. It is particularly useful for running "what-if" scenarios to see how various alternatives to the current resupply system affect aircraft readiness and support system costs. We used our research version of the AAM to determine the impact of depot and customer initiatives/adaptations that would be taken to mitigate the effects of parts shortages. The initiatives were introduced to our research version in a manner consistent with the banding philosophy. A "shopping list" of the items to buy with the limited obligation authority can now be provided to item managers. Currently, we are building a framework for institutionalizing the process described. (Analysts: Fred Rexroad, Bill Morgan, 1Lt Rob Block, DSN 787-6920)

This paper, the last of four military logistics articles, discusses the Persian Gulf War and its historical significance.

History of US Military Logistics—Persian Gulf War

Captain Jack E. King, Jr., USAF

Part IV

Introduction

At the highest echelons of command, the military objective has changed to deterrence rather than traditional victory in combat. No longer can the United States rely on overpowering its opponents. Today, war is movement. A series of pitched battles from long-held ground positions often used during the Civil War, the Spanish-American War, World War I, and in some instances, World War II, Korea, and Vietnam, will probably never again exist. Although Iraq was certainly "dug-in" during Operation Desert Storm, the overwhelming multinational air campaign pretty well denied any "quasi-pitched battles." The magnitude of any battles during Desert Shield/Storm is pale in comparison to those aforementioned. For this and other reasons, the DOD must be prepared to deploy at a moment's notice; the key to success is likely to be instantaneous response.

Persian Gulf War

As logisticians, there are several things to remember about US involvement in the Persian Gulf War. To begin, Iraq in its desperate desire to "dig in," afforded the US almost 5 1/2 months to freely build up American's forces in the Middle East—months with no enemy action on the seas, on the land, or in the air. The US Merchant Marine is all but obsolete; nevertheless, foreign contract sealift was fully utilized. Many assets were prepositioned at Diego Garcia and the Strategic Air Command* flew the majority of its missions from Diego Garcia (exploiting the absence of enemy air intervention). To assist with the airlifting of personnel and equipment, part of the Civil Reserve Air Fleet, for the first time in its history, was activated. Again, the US took every advantage of no enemy air actions. The Military Airlift Command*, during the first 30 days of Operation Desert Shield, moved an "astounding 72,000 tons of equipment and 91,000 service personnel halfway around the world [to Saudi Arabia]." (7:32) As of mid-March 1991, MAC flew 16,400 sorties transporting 544,000 personnel and 562,000 tons of cargo to the Persian Gulf. (2) The Military Sealift Command (MSC), between 7 August 1990 and 19 March 1991, was responsible for shipping 3,306,569 tons of cargo (Figure 1) while the Military Traffic Management Command (MTMC) deployed 83,628 personnel and 2,208,830 tons of cargo in support of Desert Shield/Storm. (2)

Strong support was evident. US citizens, in a show of support for forces in the Middle East, literally painted every hometown

*Now Air Combat Command and Air Mobility Command.

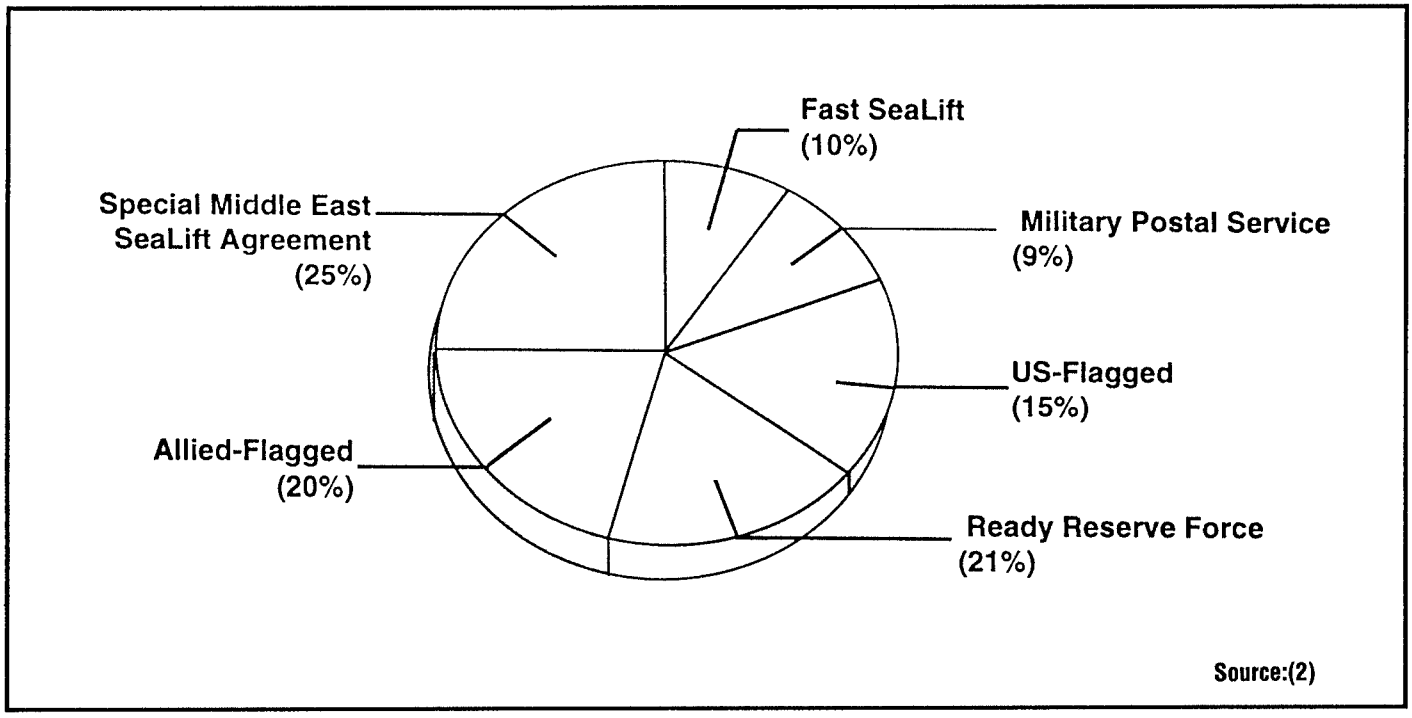


Figure 1. MSC Modes of Shipment.

in hues of red, white, blue, and yellow. Congress and the Bush Administration were behind US involvement from the beginning—this war was important enough to commit America's forces in that noble cause of freedom, and it was important enough to do so with an absolute desire to win. Many other countries displayed their support for the liberation of Kuwait (Table 1).

Country	Main Battle Tanks	Artillery, Rocket Launchers	Combat Aircraft	Armed Helicopters
Egypt	2,425	1,560	520	90
Israel	3,790	1,400	680	77
Jordan	1,130	250	110	24
Syria	4,050	2,500	510	130
Kuwait	275	90	36	18
Saudi Arabia	550	450	180	20
Iran	500	900	190	110
United Arab Emirates	130	155	60	19

Source: (4)

Table 1. Arms Strengths, 1990.

For the first time since World War II, American and Soviet leaders met each other, not as cold war adversaries or even as wary rivals to make their competition more manageable, but as partners cooperating against a common enemy—Iraq's leader, Saddam Hussein, and a demand for his unconditional withdrawal. Saudi Arabia did a great deal in supporting the coalition. Generally speaking, Saudi's infrastructure was intact, solid, and accessible by US forces. Saudi Arabia provided the bulk of petroleum products (especially jet fuel) as well as a high percentage of food stuffs. Many countries, including Saudi Arabia, contributed money and military support. Great Britain and France were actively involved with the US from the onset (Table 2).

Category	Iraq	Multinational Forces
Active Forces	430,000	356,000
Combat Aircraft	513	1,351
Combat Ships	0	117
Tanks	3,500	1,870

Source: (3)

Table 2. Iraq Versus the Coalition.

Command and control of the mammoth undertaking, noted as the largest deployment since World War II, fell squarely on the shoulders of General Hansford T. Johnson, USAF CINC of the US Transportation Command (TRANSCOM), headquartered at Scott AFB, Illinois. Testifying before a hearing of the Senate Armed Service Committee in March 1991, General Johnson said that the command's ability to mobilize such a large military force in so short a time added a new capability to America's arsenal:

> If rapid deployment prevented Saddam Hussein from moving his troops into Saudi Arabia, then mobility itself can be seen as a deterrent to military aggression. (2)

Iraq's land grab drew inevitable comparisons with the 1930s when Hitler began to gobble up Europe in pieces small enough not to provoke a military response by the powers of the day. It did not take long before fears grew that Iraq, having devoured Kuwait, would turn next to other appetizing and vulnerable Gulf nations—most notably Saudi Arabia, the richest of them all. The extent to which the NATO countries, the Soviet Union, and the threatened Arab states moved to thwart Iraq's aggression implies the leadership in that coalition has learned the lessons of history—perhaps, they are no longer "condemned to repeat it." (8)

Lessons Learned. During the years following the end of the Vietnam War, America's only humiliating military defeat, there have been those who cautioned against US involvement in any more wars, citing the lessons of Vietnam. The lasting trauma of Vietnam for the American military came in being asked to fight a war whose objective was never made clear, a war the American people were ultimately unwilling to support. Now there are new lessons—those of the Persian Gulf War—and they are as profound in their success as the lessons of Vietnam were profound in their failure.

The first lesson is the necessity of having a president who clearly articulates goals and sets about selling them to the American people. After a somewhat shaky start, President Bush found his stride—to his political and military planning, he added an outline of the oral justification for the war. Demonstration of American support was evident—yellow ribbons and American flags bathed the country.

The second lesson was the value of having international support rather than embarking on a go-it-alone strategy. Secretary of State James Baker put together a coalition of countries and revived the moribund United Nations to pass resolutions supporting American objectives and endorsing military intervention if all else failed.

The next lesson learned was the value of a battle plan. The Persian Gulf War was scripted and acted out superbly by everyone involved. Unlike Vietnam, during which President Lyndon Johnson used to brag that US planes "can't even bomb an outhouse without my approval," (5:27) General Norman Schwartzkopf and his largely ground-based command were generally left alone to pick the targets which would ensure the shortest war possible with the least involvement of ground troops. General Schwartzkopf said:

> You learn from every battle, and sometimes you learn more from negative leadership than positive leadership. (1:32)

President Bush, despite his obvious concern and commitment, allowed the military men and women to do their jobs. In essence, the Chairman of the Joint Chiefs of Staff, Army General Colin Powell, and his compatriots respected, not replicated, the lessons of the past. In General Powell's own words:

> If you're going to go in, go in big and get it over with fast. (1:29)

Another lesson was learned by the Pentagon, which handled the press brilliantly. The press was tightly controlled in four recent military conflicts: the British invasion to take back the Falkland Islands, the liberation of Grenada from Marxist communists, the toppling of the dictator Manuel Noriega from Panama, and the liberation of Kuwait from the clutches of Saddam Hussein. Is it a coincidence each of these was successful?

Three principles of air war were immediately clear: air superiority is indispensable to victory in modern war; all forces which fight in the air require a single, unifying command and control authority if they are to take fullest advantage of their capabilities; and advanced technology, coupled with realistic training, wins wars. These precepts, central to Air Force doctrine, have been validated by Operation Desert Storm.

President Bush, on 1 March 1990, proclaimed the Vietnam syndrome was over. Several classic principles of war provide a framework for comparing the Vietnam and Persian Gulf Wars. (9:23) The first and perhaps most important principle is the

"objective." In Vietnam, most US generals (as many as 70%) were uncertain of the goals of the war. The "offensive" is the second principle. Quite simply, it mandates America to carry the war to the enemy and destroy its armed forces. Vietnam was overshadowed by the US policy of containment. In the Persian Gulf, the military's hands were untied for the first time since World War II. "Mass," the third principle, dictates the main effort is exerted toward attainment of the main objective, while "economy of force," the fourth principle, covers secondary objectives. Mass and economy of force are closely interrelated. America had help with these two principles—it was the Soviet Union, after all, which enabled the US to mass its forces in the Gulf while leaving an economy of force to guard Central Europe. Getting the required mass of force to the Gulf involved yet another principle, that of "maneuver." More than 500,000 troops, along with their arms, equipment, and supplies, had to be transported from the US or Europe to the Gulf. The principle of "security" was virtually nonexistent in Vietnam. On the other hand, restrictions on the press in the Gulf raised a few whimpers, but in the end justified its necessity. The principle of "simplicity" serves as a kind of litmus test for all of the other principles. The Vietnam War was one of the most complicated ever waged. Confusion manifested itself on every battlefield. The attrition rate due to "friendly fire" was phenomenal. Desert Shield, by contrast, was the model for simplicity, especially in the lines of communication, command, and control. This was particularly noteworthy for, like Vietnam, politics made it impossible to achieve the principle of "unity of command." All forces could not be subordinated to a single leader. But through cooperation among the allies, unity of purpose was achieved. The multinational air campaign and the 100-hour multinational ground campaign that followed attest to a single purpose—Iraq's unconditional withdrawal from Kuwait.

Some problems do exist. Attention in the 1990s to the federal deficit, and demands from influential people with their eyes on a "peace dividend," have forced large reductions in the DOD budget, despite continued military personnel on duty in the Middle East.

Summary

Military logistics history is not merely the study of obscure fact and footnotes. The intelligent study of military logistics history provides insight into the evolution of strategic thought, the political and military objectives of warfare, the influence of technology on operational concepts, and the capabilities and limitations of military forces. History provides examples of success and failure in military operations and provides clues relating to the reason for the success or failure. As a nation, the US must not be forgetful of the past. Americans cannot avoid, by omission or lack of emphasis, the learning possible from history.

George Washington, in the First Annual Address to both houses of Congress on 8 January 1790, said:

> To be prepared for war is one of the most effectual means of preserving peace. (10)

Although the probability of another world war may be slim for the near future, it would seem prudent for all Americans to heed this advice.

Technology has jumped by leaps and bounds culminating in sophisticated and mechanized warfare. Best records indicate that the US used at least 100 pounds of supplies per man per day in Vietnam. For "Operation Just Cause," the requirement grew to more than 125 pounds of supplies per man per day. (6) Operation Desert Shield requirements were far in excess of 140 pounds of supplies per man per day (bearing in mind Saudi Arabia furnished the bulk of petroleum, oil and lubricants (POL) and a significant percentage of food). Much of that weight is attributable to the heavy, sophisticated equipment used to complement today's technological leading edge in American weapon systems.

From a historical perspective, it is reasonable to presume the supplies and equipment produced in one war tend to become, to some extent, the reserve of the next. Such reserves provide a cushion, of sorts, permitting industrial mobilization of a nation to meet materiel requirements. Before current demands could be met through new procurement, World War I assets proved to be valuable in the early stages of World War II. It must be noted the lend-lease program also contributed handsomely to meeting a surging wartime materiel requirement during this period. Certainly, equipment and supplies left over from World War II provided support that otherwise would not have been available for early combat operations in the Korean War. Early requirements for the Vietnam War were no different. So, too, was the case in Desert Shield/Storm. Some of the equipment and supplies were modified versions of the same used in the Vietnam War. Examples include the F-4 Phantom aircraft and the C-130 Hercules aircraft.

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Captain Jack E. King, Jr., wrote this article while a graduate student at AFIT. He is presently assigned to Warner Robins ALC, Robins AFB, Georgia.

This series of articles (Fall 1991, Spring 1992, Winter-Spring 1993) examined problem areas common to many of the campaigns fought by US forces during the past 50 years. Although the history of such campaigns cannot always provide solutions to current problems, it can provide a fresh perspective and rekindled insight into those problems. History can establish a firm foundation from which the right kinds of questions may be asked.

Mrs. Jane Allen, the Assistant Editor of the Air Force Journal of Logistics, recently retired from civil service after serving her country for over 35 years. Throughout her 12 years with the Journal, Jane has been the mainstay of the operation. For a number of these years, she essentially determined the content and assembled and edited the Journal entirely without assistance. The Journal was in its infancy when Jane graced the staff. Her dedicated, meticulous, and creative efforts resulted in the evolution of the Journal as it is today. Needless to say, she will be sorely missed.

I wish Jane good health in her retirement and great success in all her future endeavors.

Lt Col Newell

Turning the Pages

After serving 12 years as an editor for the Air Force Journal of Logistics, and 35 years as a civil servant, I am ready to venture into a new chapter of my life—that of a retiree.

These 12 years have been very exciting and fruitful, and I am confident that, along the way, the Journal has played a key role in solving logistical problems, preserving peace, and saving lives.

During this period, we published stimulating, thought-provoking articles on the Falkland Islands campaign, the Deployable Mobility Execution System and its support of Grenada operations, the invasion of Panama, and world-shaking events in the Soviet Union; some other pertinent articles covered computer technology, strategy, vulnerability, space, hazardous waste, and combat support doctrine. It was especially rewarding to feature women in the military yesterday and today. I interviewed fascinating women who answered pertinent questions and expressed themselves candidly about their careers—it was an enlightening experience.

We also presented lessons learned down through the centuries—from the Macedonian Army operations in 334-333 B.C. to the Persian Gulf War in 1991—to better prepare logisticians for future conflicts. For we all know that we are not out of danger. Every day there is a new crisis in our global village—in Korea, China, Bosnia, and the Middle East. Hussein is not "sleeping" and may raise his treacherous saber once again. We have to be ever watchful and be just as prepared now as in the past—only with less people and funds.

I appreciate the valuable comments, advice, and encouragement I received from all our Editorial Advisory Board members. I was honored to meet such distinguished logistics warriors as Jerry Peppers, I. B. Holley, and the noted author, Martin Van Creveld.

Thanks to all the military and civilian readers who shared their knowledge and experience with others to make our Journal the most credible logistics magazine in the Air Force. I am deeply indebted to Ted Kluz, Dave Rutenberg (with whom I co-edited The Logistics of Waging War), Mike Rigsbee, and Bruce Newell, as well as to the members of the Air Force Logistics Management Agency, for giving me tremendous support and cooperation, and the freedom to be creative. It was a privilege to be associated with these progressive thinkers.

Thanks also to the personnel at the Public Affairs offices, publishing offices, printing plants, and graphics, who in performing their individual tasks so masterfully, contributed to the overall success of the magazine.

I know the Journal will continue its tradition of excellence; and I urge our readers to continue writing important, top-quality articles.

Happy Logistics,

Jane Allen